SCIENTIFIC AMERICAN

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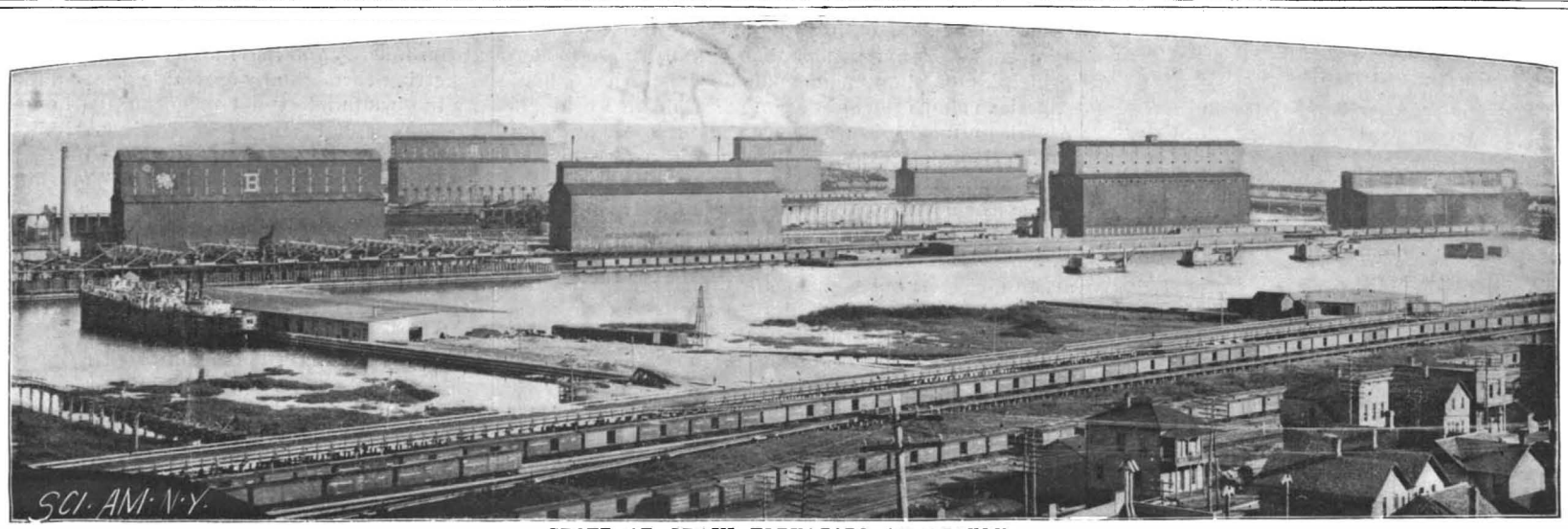

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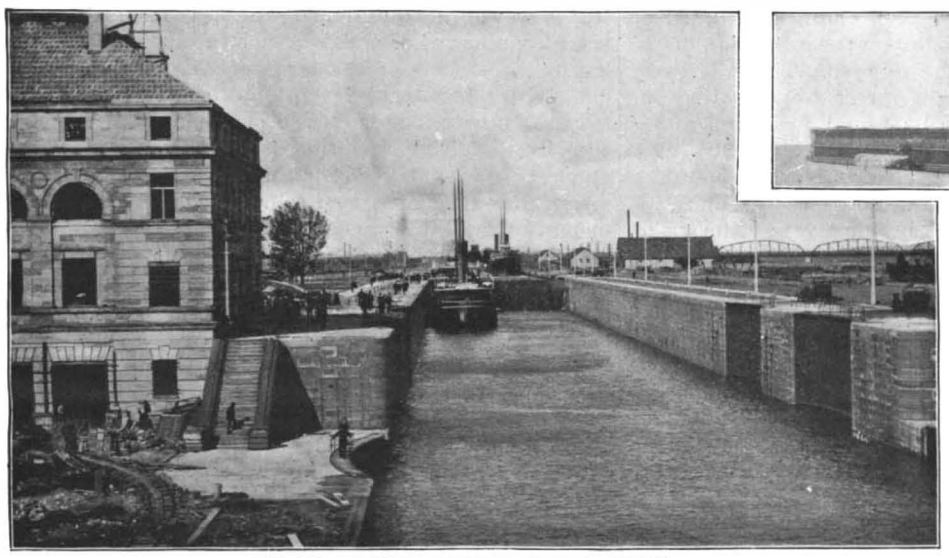

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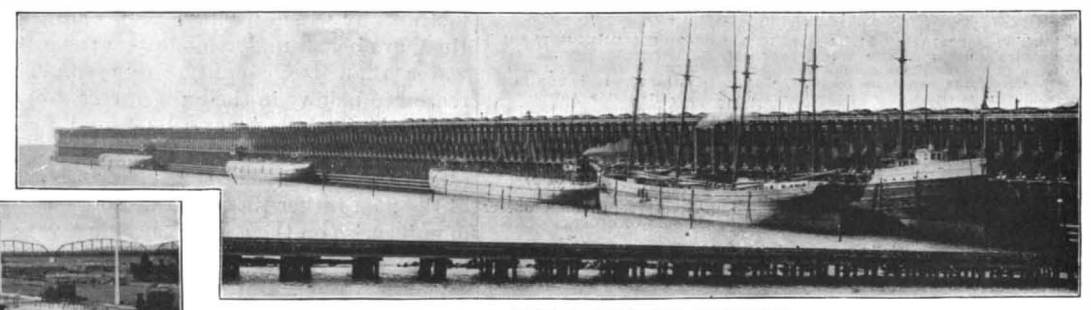

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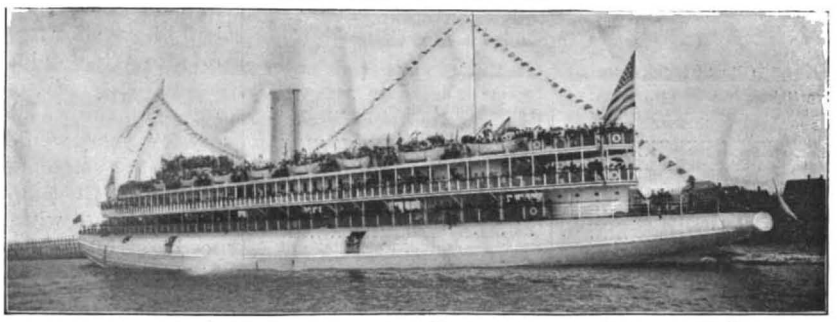

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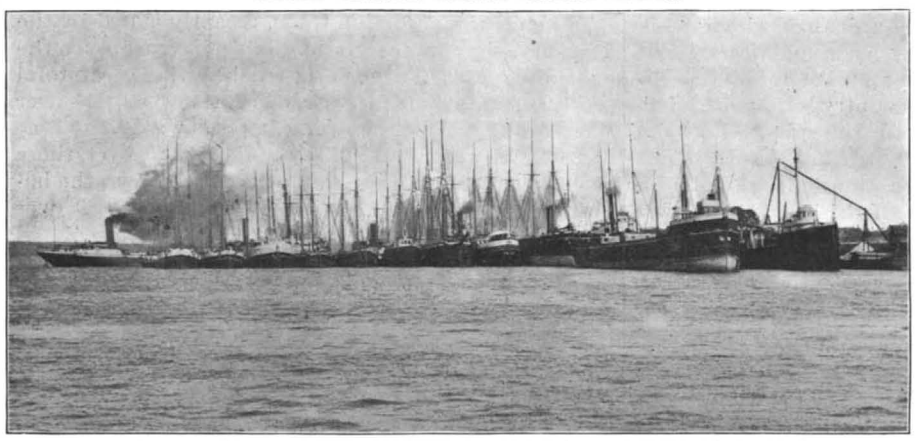

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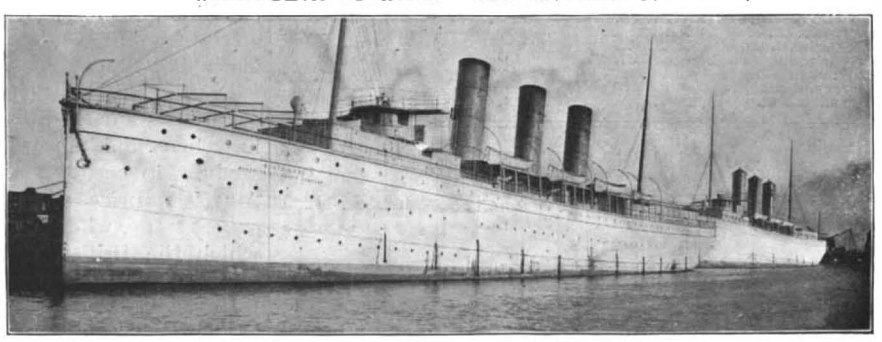

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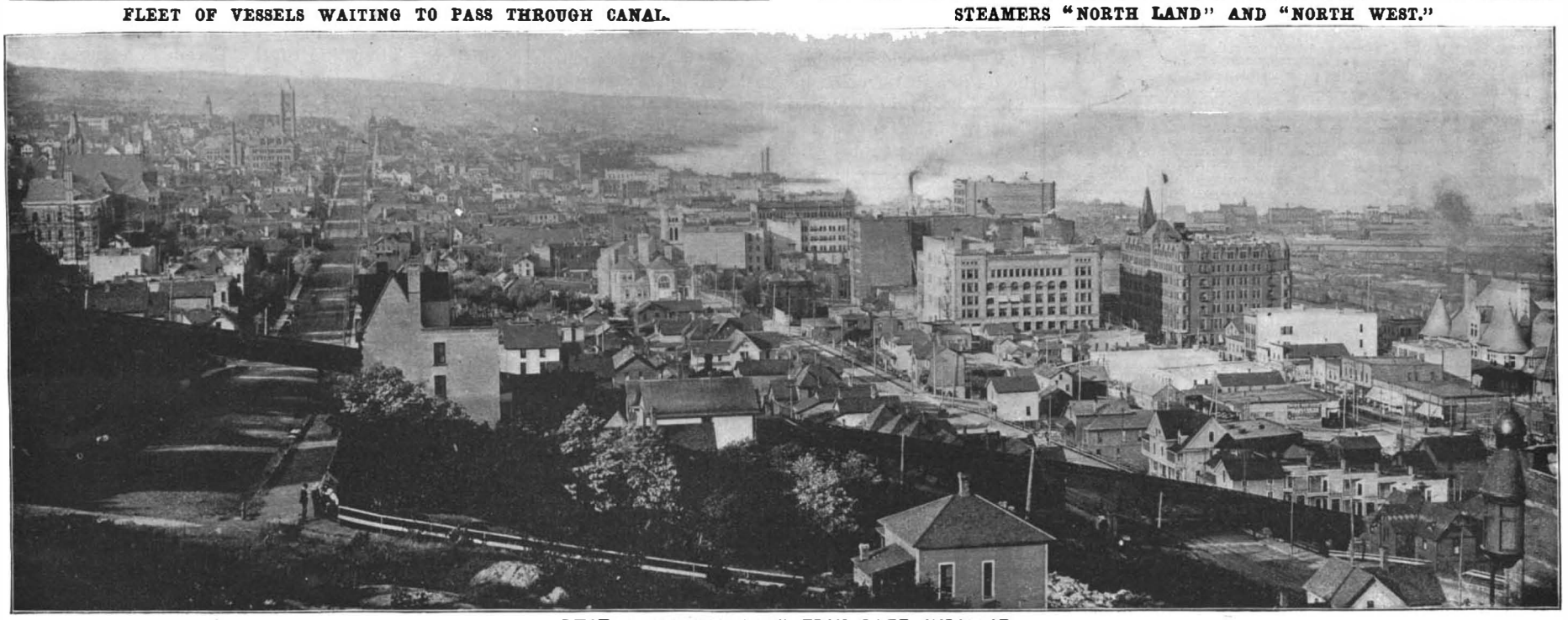

DULUTH LOOKING EAST UPON LAKE SUPERIOR.

COMMERCE ON THE GREAT LAKES.—[See page 119.]

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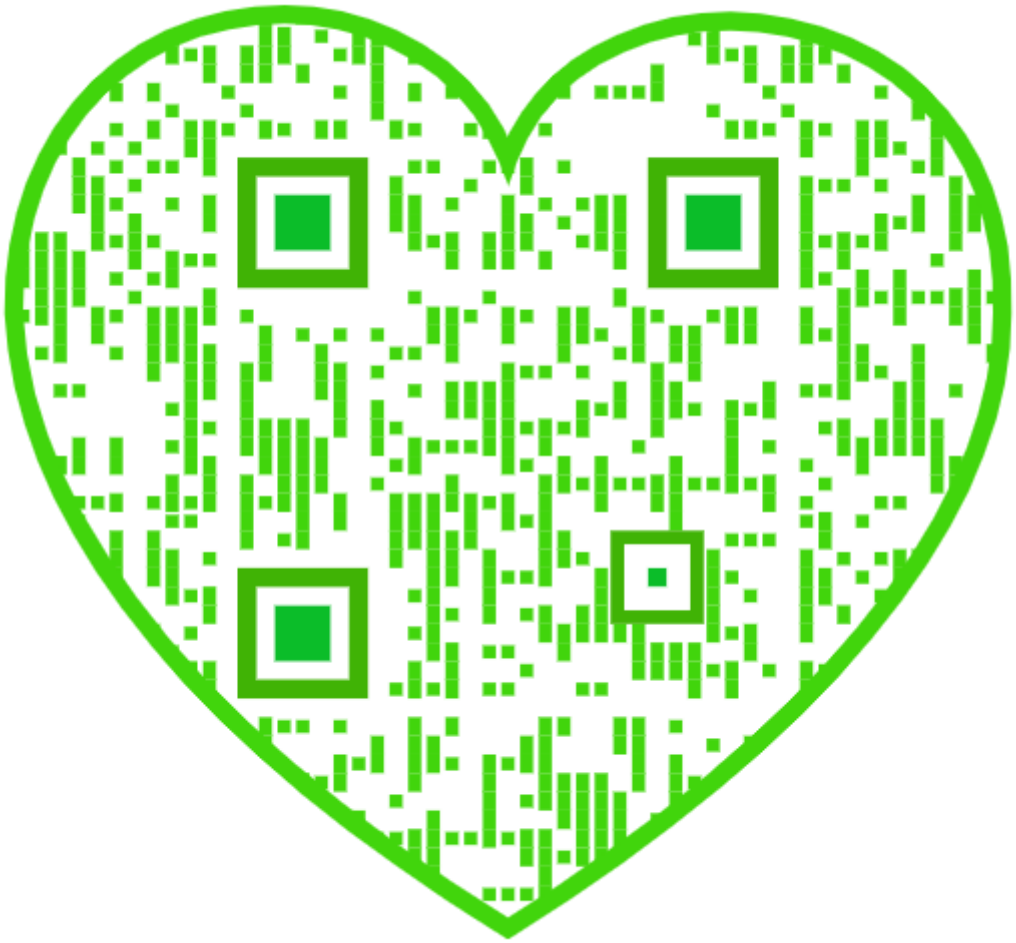

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ECONOMIC ASPECT OF THE ENGLISH ENGINEERS' STRIKE.

Looked at from the American standpoint, it is evident that in the recent struggle between employers and men in the English engineering trades, the employers have been fighting for the interests of labor fully as much as for their own. While the ostensible object at which the Amalgamated Society of Engineers was aiming was the reduction of the working time of the men to forty-eight hours a week, or eight hours a day, the actual object was the control of the output of work, the right of the society to determine the proper amount of finished product to be turned out by a given amount of labor. In other words, the fight has not been so much one of labor against capital as of labor against labor-saving machinery and those modern principles of shop management which have made American shops the most economical in the world and American machinists at once the best paid and most productive that ever stood at a vise or ran a shop tool.

The theory that the introduction of labor-saving machinery is prejudicial to the interests of labor is one that has long ago been exploded in this country. Our artisan classes have come to understand that the cheapening of a product, due to the use of improved machinery in its manufacture, increases its sale and demand to such an extent that for one skilled artisan who is displaced five others are employed to meet the demand so produced.

Indirectly the late strike may be traced to the influence of American competition upon the British engineering trades. The wonderful strides which we have made, especially in the past decade, have been closely observed by English manufacturers, and the methods by which we have been enabled to undersell them are better understood upon the other side of the water than is generally supposed. There is every reason to believe in the light of recent events that the survival of what Americans would term antiquated tools and out-of-date methods in some of the first-class establishments of that country is due to the opposition of the men rather than to any conservatism and lack of enterprise on the part of the employers. The strike, looked at in this light, was a conflict between the old order of things and the new, and luckily for both masters and men it is the new that has triumphed. Had the labor unions prevailed, subsequent history would have shown that the victory was a hollow one and altogether delusive. The right of the unions to determine the output of labor would have proved a drag upon the wheels of British industry which in a very few years would have left it hopelessly behind in the race for commercial supremacy.

Now that the employers are at liberty to run their establishments with a free hand, we may look for a speedy assimilation to American methods and an extended use of American tools—a change which, while it may render the English keener competitors, is certain to open an ever increasing market for the special machine tools for which this country is famous. It is an interesting question how far the adoption of our methods will enable England to compete successfully with us in those lines on which we are at present able to undersell her. Unless the British manufacturers have been making exceptional profits, it is difficult to see how in certain lines they can ever come down to American prices; as, for instance, in the locomotive export trade, where we can deliver an engine for $7,000 which the British manufacturer refuses to build for less than $10,000.

However, it is certain that in spite of the temporary loss to both capital and labor, the late struggle will prove to be a positive benefit to the engineering trades of Great Britian. Unless we are mistaken, the $15,000,000 in wages and the $200,000,000 in trade which the six months' struggle has cost will ultimately prove to have been no extravagant price to pay for the vindication of the fundamental economic principle which has now been established.

EXTENSIONS OF PATENTS.

It is a notable fact that the instances in which extensions of United States patents are granted are now, and have been since 1861, extremely rare, and such also seems to be the case in England, although, according to The London Times, the judicial committee of the Privy Council did, on December 9, extend the duration of a patent beyond the usual term of fourteen years. This was the Timmis patent, taken out in 1883, for a new method of working and interlocking railway signals by means of electricity. The patentee "laid stress on the dislike of the companies to make use of a novel and untried method, and on the circumstances that he was out of pocket, and had so far earned no profits." The Times very justly remarks that "No doubt many inventors of useful contrivances find, at the close of the period covered by their patents, that they have made little way. Prejudice has to be overcome, interested opposition to a novelty may be strong, or the need for the invention may not be great until such period is nearly run out," and suggests that this ten-year extension "will encourage inventors to ask a similar boon oftener than has been customary," as "many other inventors of equal merit find themselves at the end of the period covered by an original patent in a worse plight than his."

Whatever encouragement, however, may be afforded by this precedent to those seeking extensions of English patents, it is evident that the matter of obtaining extensions of United States patents stands on a very different footing. Applications for such extensions in England are examined by a committee of the Privy Council, composed of eminent noblemen, the leading law officers, and other officials, who may always be expected to expedite hearings and make a decision equitable alike to the public and the patentee; while here an extension is only to be had by act of Congress, and the great difficulty and inevitable delay always experienced in getting through any special legislation in that body are too well understood to encourage hope of success on the part of inventors who might think they had good ground to apply for extensions of their patents. There has been but one extension of a United States patent in the last twenty years.

But this has not always been the case in regard to United States patents. By the act of 1836, the Commissioner of Patents was empowered to grant extensions of patents, the Secretary of State and the Solicitor of the Treasury, in conjunction with the Commissioner of Patents, being then constituted a board to hear evidence in support of applications for such extensions. By the act of 1848 the power to grant extensions was conferred on the Commissioner of Patents solely, but by the act of 1861, by which the term of a patent was made seventeen years, instead of fourteen years, as had previously been the case, all extensions for patents granted thereafter were prohibited.

It may well be questioned whether this legislation was altogether wise, and whether the mere lengthening by three years of the terms of all patents should operate as a bar to any extension of a patent, no matter how meritorious the case, or what might be the equities involved—for this is practically what it amounts to when the sole power to make extensions is reserved by Congress to itself. Even were congressmen always willing to entertain probably meritorious cases, there are too many members to permit the House to make any practical examination of the questions which might thus arise, but which would be quickly disposed of by a small board of disinterested officials, in conjunction with a representative of the Patent Office. Such a board, including possibly a justice of the Supreme Court, might be depended upon to safeguard the interests of the public in all cases, and still, in many instances, grant extensions on meritorious patents which had so tardily come to be appreciated by the public as to yield the inventors no return.

OUR INCREASING FOREIGN TRADE.

The statistics of foreign trade, recently issued by the Treasury, show a truly remarkable increase over the preceding year. The exports reached the great total of $1,099,129,519, an increase of some $93,200,000 over those of the year before. The imports were valued at $742,630,855, an increase of some $61,000,000 over those of the year 1896. The excess of the exports over the imports was $356,498,664, an increase of $32,200,000 over the excess of the previous year. The figures of the exports and imports of gold coin and bullion show a decrease, the exports being $34,174,182, a decrease of some $23,800,000 over the year 1896, and the imports being valued at $29,079,540, a decrease of no less than $73,600,000 for the year.

It is noteworthy that the figures for December are considerably higher than the average monthly figures for the year, showing that the growth of the foreign trade is steady and likely to continue under existing conditions. The value of the December exports was $124,474,435, and of the imports $51,514,733, an increase of the exports of $7,200,000 and a decrease of the imports of $7,400,000, compared with the figures for December of 1896. The excess of the exports over the imports for the month was $73,900,000, as against an excess of $58,200,000 in a comparison of December of last year with the same month in 1895.

In this connection the figures of British foreign trade for 1897 will be of interest. The total value of exports was $1,150,000,000, a decrease of $28,500,000 on the preceding year, and the imports reached the enormous total of $2,020,000,000, an increase of $46,500,000. The decreased exports are attributed to foreign tariff restrictions, particularly those of this country, and to the engineering dispute referred to in another column.

THE INDUSTRIAL OUTLOOK IN EGYPT.

The former United States consul at Cairo, Mr. F. C. Penfield, has contributed to the February number of The Forum a valuable paper regarding the agricultural development of Egypt which has occurred under the so-called protectorate of Great Britain.

The writer holds decided views as to the moral aspects of the continued occupation of Egypt, so long after the ostensible objects of that occupation have been achieved. He is convinced that the British government not only intends to remain permanently in pos-

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session of Egypt and the reconquered districts, but that it intends to recover the whole of the eastern Soudan, and that the reconquest is preparatory to an important scheme of industrial development. The fact that Mr. Penfield condemns the occupation on moral grounds does not deter him from giving full credit for the great improvement which has taken place in the condition of the Egyptian people, and the present article, like all his contributions, official or otherwise, on this interesting topic, is both valuable and timely.

It was pointed out many years ago by the African traveler, Sir Samuel Baker, that if the great volume of water in the Nile were controlled, it would be possible to transform the Nubian desert into a vast cotton field, whose harvests would go far to render England independent of the cotton supply from the United States. Already, indeed, the lower Nile valley is a productive cotton field, and under the British occupation the area under cultivation has doubled. The new irrigation works which are continually being constructed enable larger areas to be planted, and the yield is steadily increasing.

The Egyptian cotton has a special value on the market, owing to the exceptional length of its fiber, and last year's crop of 1,100,000 bales was sold for two cents per pound more than was realized for American upland cotton. The Egyptian cotton is extensively used both in Europe and in this country, our importation amounting annually to about 100,000 bales. To this advantage in quality must be added the fact that the Egyptian climate is particularly suitable to the raising of cotton, the average crop being about 560 pounds per acre. Labor, moreover, is cheap, wages averaging only about eighteen cents per day for each hand. With this high yield, high market price and small cost of labor, it is not surprising to learn that about $55,000,000 are realized from the cotton crop alone. It is probable that a large increase in this amount will result from the increased acreage which is being brought under cultivation on the Nile delta. Mr. Penfield is of the opinion that five years from now the total output from this district will be one and a half million bales—an increase of some forty per cent on the present yield. The revenue obtained from cotton alone suffices to pay the interest on a heavy debt and to carry on the government. It is stated that were it not for the present military expedition up the Nile, there would be an actual surplus in the Egyptian treasury.

The writer of this interesting article points out that the conquest of the Soudan will probably result in the cultivable districts being devoted to wheat raising, and the great tracts of country will once again, after the lapse of centuries, be devoted to husbandry. If this should happen, the great Nile basin will once more become, as it was in the days of the Pharaohs, one of the great granaries of the world. Furthermore, it is stated that, within the last two years, and more particularly since the disastrous war in Cuba, the cultivation of the sugar cane has been taken up in several parts of the Nile valley. The sugar is stated to be of excellent quality, and there was a sufficient amount of it raised last year to increase the wealth of Egypt by about $8,000,000. The writer states that the area devoted to the sugar cane is likely to be doubled within a short time. It is possible that the Egyptian sugar crop will cut a not inconsiderable figure before long in the statistics of the world's supply.

COMMISSIONER DUELL SWORN IN.

Mr. Charles H. Duell was sworn in as Commissioner of Patents on February 5. The oath was administered by Assistant Chief Clerk W. H. DeLacy, of the Interior Department. After the ceremony Mr. Duell went into conference with Assistant Commissioner Greeley, and the greater part of the day was spent in discussing Patent Office affairs. The new Commissioner promises to be popular, as he is very approachable and has the faculty of making the visitor feel at ease. He said to the representatives of newspapers that he was acquainting himself with the situation and he did not care to discuss the question of the office until he was thoroughly acquainted with the condition of affairs. He referred the newspaper men to Assistant Commissioner Greeley, who said:

"We are deeply interested in the pending appropriation for the support of the Patent Office during the coming fiscal year. The appropriation bill, as reported, provides for a slight increase in the working force of the office, but it is so slight as not to materially affect the conditions, which even now are becoming of monstrous proportions. The new bill, I believe, gives us a new principal examiner, nine assistant examiners and three messengers. We originally estimated for four principal examiners, thirty-six assistant examiners, thirty-five clerks and ten messengers. The Secretary cut this estimate to two principal examiners, eighteen assistants, eleven clerks and fourteen messengers. This matter of additional help is a most serious problem, more important to-day than ever before, and becoming more so every twenty-four hours.

"Even with the small increase allowed by Congress, we would be better off, if only the appropriation were made immediately available. But, instead of that, the additional help cannot be utilized until next July, and by that time this office will be seriously behind in its work. To-day our examiners are from three to four months behind in their work, and some divisions are as much as six months behind.

"We have on hand, in round numbers, awaiting action, 13,000 cases, of which number 9,600 have never been looked at. In the next four months our business will largely increase. March, April, May and June have heretofore been the heaviest months of the year, and there is no reason to doubt the record will be kept up. So you see, when July comes around, we will be hopelessly behind. I estimate we will receive in that time 14,000 new cases. So it is easy to understand how important it is to have an adequate force to do the work. It is not generally understood what a large proportion of the government revenue comes from this office. Last year we covered into the Treasury, after paying the running expenses of the office, $317,135.05, and the books of the Treasurer of the United States show a total of $5,093,614,23 paid to the general government by the Patent Office after paying all its expenses. The inventors are protesting against the delay. They claim, and very properly, too, they are entitled to prompt and efficient service. The government requires them to pay for the work in advance, and then they are required to wait for months before having their applications attended to. One thing is certain, the efficiency of the Patent Office demands, in the interest of its clients, a suitable force of employees to prosecute the work intrusted to it."

CHANGES IN FOREIGN PATENT LAWS AND PRACTICE.

Political events in 1897 have apparently influenced the patent legislation and the patent practice of several countries, and it is interesting to note that while in some cases the securing of protection for inventions has been facilitated, in others a spirit hostile to foreign inventors is manifested.

Peace having been concluded between Turkey and Greece, both of these countries are naturally intent upon fostering commercial and industrial development. Although no patent law exists in Greece, special grants have been made to protect inventions, and the legislature has lately been found to be more liberally disposed, so that the expense of securing such grants has been reduced to a reasonable figure. Greece, owing to its commercial relations, is one of the most important nations on the eastern Mediterranean, as the Greeks have extensive relations with Turkey in Europe and in Asia and Egypt. Inventions relating to navigation and to mining or quarrying would seem to be particularly adapted for introduction in Greece. Turkey's industrial development is seriously hampered by various ordinances, one of which prohibits the use of electricity in the empire, yet there is a party in favor of modern improvements, and even the government is now making strenuous efforts to stimulate trade. It is to be noted, however, that no patent will be granted in Turkey for improvements in arms or ammunition, or for any machine in which electricity is to be used as the main motive agent.

The courts of Egypt have granted efficient protection to foreign patentees when legalized copies of the foreign patent have been deposited in Egypt, according to certain formalities. If the patent is for a machine, two photographs of the patented article should also be supplied. Since the British occupation, Egypt has developed very rapidly, and its natural resources will undoubtedly enable it to regain, in a large measure, its former importance as an agricultural country. Egyptian cotton is known as one of the best upon the market. The modernizing of Egypt is progressing very rapidly, steam and electric railways being continually extended, and American manufacturers ought to avail themselves of the opportunities thus offered.

The South African Republic (Transvaal) on October 15, 1897, put into operation a new patent law which is extremely illiberal to foreigners. Every applicant for a patent who resides abroad is required to furnish, with the application, a bond or other approved security to the amount of $500. This is for the purpose of meeting the cost of contesting any opposition that may be made to the grant of the patent. Inasmuch as the government may award costs to the opponent in case he is successful, the expense of contesting an opposition may be very considerable. Of course, in case the patent issues without opposition, or if the opponent has to pay the costs, the security will be refunded. Efforts are being made to secure a reduction of these prohibitive rates.

Japan having in 1897 enabled foreign inventors to secure protection by patents, American manufacturers and inventors have largely availed themselves of the opportunity of strengthening their position in this promising field. The practice of the Japanese patent office in regard to applications made by foreigners has been settled, and the requirements as to novelty are substantially identical with those made in accordance with British patent practice, that is, the application must be filed before the invention becomes publicly known or used in Japan. More particularly, the application should be filed before a copy of the United States patent reaches the Japanese patent office.

China grants no patents, but nevertheless protects foreign inventors who have obtained patents in their own country. To secure this protection, certain formalities have to be complied with, and the patentee must establish his right by filing duly certified copies of his patent and any other documents proving his title. There is no doubt that China will soon enter upon a period of modernization similar to that which has brought Japan into such prominence, and already we hear of considerable activity in railway construction and in the starting of new factories, such as spinning mills. The competition of British, German and Japanese manufacturers upon the Chinese market is very keen, and American exporters will do well to secure protection for inventions which otherwise might be controlled by their foreign competitors.

TWO INTERESTING DISCOVERIES IN ITALY.

Two discoveries have just been made in Italy, one in Rome and one in Florence, which are of the utmost importance. Signor Marucci, the archæologist, has discovered an imposing wall painting in the Palace of Tiberius on the Palatine Hill. It is considered that this picture will prove an important addition to Christian history. The painting evidently represents the preparation for the crucifixion. Around the cross are soldiers bearing ladders and under each soldier is written his name. Among them will be found Pontius Pilate. The figures are $5\frac{9}{10}$ inches high. The inscription consists of fifteen lines, of which five have been deciphered. It contains the name "Christus." The Pope was immediately informed of the discovery, and Signor Marucci will shortly publish a monograph on his discovery. When all of the mediæval and modern buildings have been cleared off from the Palatine, it is probable that other important discoveries will be made.

A fresco by Ghirlandajo in the Orgnissanti Church, at Florence, has been discovered in the ancient Vespucci Chapel, which contains a portrait of Amerigo Vespucci. Students of art history have for a long time believed that the fresco was lost when the chapel was whitewashed in 1616, though it was perfectly well known that it had existed at one time. It is mentioned by Vasari, who says, "Domenico (Ghirlandajo) has portrayed the likeness of Amerigo Vespucci, who sailed to the Indies." A contemporaneous portrait of this important personage in the history of the discovery of the new world promises to be another one of the artistic sensations of Florence like that of Botticelli's "Pallas" two years ago.

THE SAFE DEPOSIT BUSINESS IN ANCIENT ROME.

We are inclined to consider that safe deposit vaults are entirely an invention of the nineteenth century, but this is not the case. In 1885, during the building of the quarter of Testaccio, in Rome, which was the region of the public granaries, an official advertisement was found for leasing a "horrea," or public granary, under the empire of Hadrian. The advertisement is given in Prof. Lanciani's interesting work, "Pagan and Christian Rome," as follows:

"To be let from to-day, and hereafter annually (beginning on December 13): These warehouses, belonging to the Emperor Hadrian, together with their granaries, wine cellars, strong boxes and repositories.

"The care and protection of the official watchmen is included in the lease.

"Regulations: I. Any one who rents rooms, vaults or strong boxes in this establishment is expected to pay the rent and vacate the place before December 13.

"II. Whoever disobeys regulation No. I, and omits to arrange with the horrearius (or keeper-in-chief) for the renewal of his lease, shall be considered as liable for another year, the rent to be determined by the average price paid by others for the same room, vault or strong box. This regulation to be enforced in case the horrearius has not had an opportunity to rent the said room, vault or strong box to other people.

"III. Subletting is not allowed. The administration will withdraw the watch and the guarantee from rooms, vaults or strong boxes which have been sublet in violation of the existing rules.

"IV. Merchandise or valuables stored in these warehouses are held by the administration as security for payment of rental.

"V. The tenant will not be reimbursed by the administration for improvements, additions and other such work which he has undertaken on his own account.

"VI. The tenant must give an assignment of his goods to the keeper-in-chief, who shall not be held responsible for the safe keeping of merchandise or valuables which have not been duly declared. The tenant must claim a receipt for the said assignment and for the payment of his rental."

Many of the temples were also used for the keeping of money, jewels, plate, etc. Of course, the temples were constantly watched, and on this account were safe from thieves. Official weights and measures were also kept in the temples.

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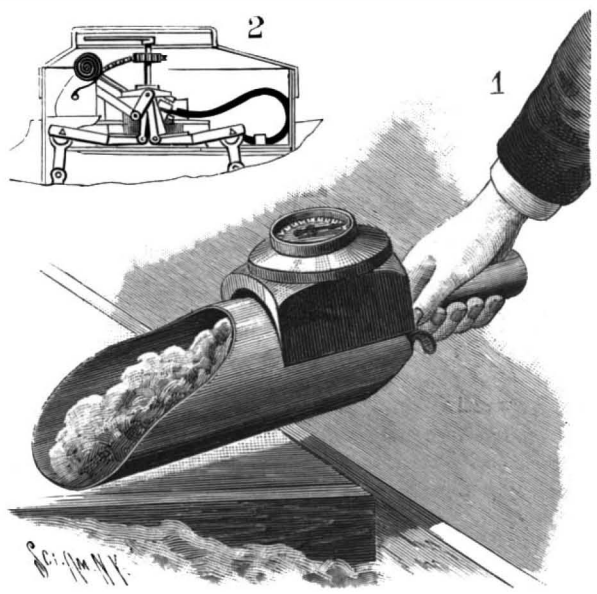
AN IMPROVED WEIGHING SCOOP.

The illustration represents a convenient device for use in the household, in hotels and warehouses, and by retail merchants and others. In connection with the usual pan of a scoop is arranged a scale mechanism, whereby the contents of the pan may be weighed and the weight indicated by a pointer moving on a dial face, as shown in Fig. 1, Fig. 2 representing a sectional view of the scale mechanism. The invention has been patented by John M. Withrow and W. H. Theobald, of Apalachicola, Fla. The scale mechanism is carried by a sunken portion of the bottom of the casing to which the handle is secured, the handle portion having skirts forming a downwardly opening cavity receiving the upper portion of the scoop or pan. At each side of the pan are links with eyes in which are knife edges resting upon pairs of arms connected by beams, each beam with its arm forming a lever rocking on a fulcrum formed by knife edges for each arm rolling in bearings on the braced bottom of the handle casing. The intermediate portion of each beam is connected by links to a carriage which slides vertically

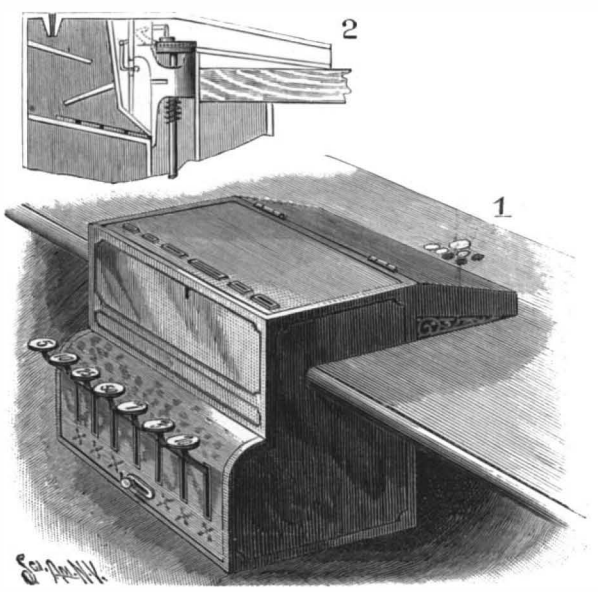


WITHROW AND THEOBALD'S WEIGHING SCOOP.

on the arbor carrying the pointer of the scale, a scroll spring being arranged to normally lift the pan. Weight placed in the pan causes the arms which rest in the knife edges of the eyes from which the pan is supported to swing down, throwing up the carriage, which is so connected as to cause the turning of the arbor and the movement of the pointer on the dial. The tension of the spring may be readily regulated, and a proper adjustment of the parts causes the indicator to show the weight of material in the pan. By means of a thumb plate the pan may be held rigidly, if it is not desired to utilize the weighing mechanism.

SMITH'S CHANGE-MAKING DEVICE.

To facilitate the changing of coins or bills by rapidly and accurately bringing out the required change by operating proper levers is the object of the invention illustrated by the accompanying figures, and which has been patented by Andrew A. Smith, of Westport, Wash. It comprises essentially a casing having a number of coin receptacles or hoppers, each of which contains coins of one denomination only, and mechanism by which one coin at a time may be produced from either of the hoppers. Fig. 1 is an outside view of the complete device, Fig. 2 showing a section through one of the hoppers. The case is intended to be placed at the rear of a counter, with its upper portion slightly above the surface—though not interfering with the display of goods by a salesman—a tube discharging the coins upon the counter opposite the case, as indicated in Fig. 1. The cover of the case is hinged, to afford ready access to the interior, and has a series of slots, beneath each of which is a coin receptacle similar to that shown in Fig. 2, the inclined projections in the receptacles preventing the removal of coin by turning the case over. In the sloping bottom of each coin receptacle is a slot which will pass but one coin at a time, and opposite these slots are coin-receiving cups having false bottoms attached to vertical rods on which are spiral springs, normally holding the cups in lowered position. The cup-supporting rods are, however, pivotally connected with levers whose outer ends project through slots in the casing, terminating in keys marked with the denominations of the coins in the different receptacles; and on the depression of the proper lever, when it is required to make change, the cup and its false bottom is elevated, the latter coming in contact with a pivoted discharge lever, the tripping of which causes the coin to be thrown into the discharge spout. One or more of the keys are thus depressed to operate the levers to discharge the required coin from the different receptacles, according to the change desired. The cover is provided with a lock, to prevent unauthorized access to the interior of the casing, and within the casing is a lock plate which may be moved to prevent operating the keys.



A NOVEL CHANGE-MAKING DEVICE.

The Forgotten Colonial Library.

The tearing down of the building which covered the east wall of Independence Hall has brought forward some unexpected testimony in confirmation of the specifications, as well as some unanticipated facts which are of great interest and importance. The face of this wall shows unimpeachable evidence of a building having existed of which the present generation had no knowledge, and to which reference is made in all old documents, letters, etc., but which had dropped out of sight. It is barely a century since stood fully equipped the "Colonial Library," corresponding to our "Congressional Library" of to-day, from which public men indited their correspondence. Well might Scrooge say, "And are we so soon forgotten?" But it is hard to think that the existence of such a building should have had no record. It has, fortunately, left its own record on the wall of the old State House. Concerning the Colonial Library, Frank M. Etting's "History of Independence Hall" says, on page 26, a resolution was adopted in 1752 to place at the southeast corner of the State House a structure for the use of the committees and "for our books." Etting adds that "the absurdity of such a building must have prevented its accomplishment." But here is the unimpeachable evidence that it was built, and the further evidence of correspondence dated from it. It probably went down with the changes made in 1813.—Philadelphia Ledger.

GAS AND GASOLINE ENGINES.

The steadily increasing popularity of gasoline power for driving machinery and for propelling boats has led to the perfection of a gas and gasoline engine, by the Mianus Electric Company, Mianus, Conn., which is peculiarly fitted to supply the demand, excelling in economy, safety and durability. The company are manufacturers of complete gas or gasoline engines of from one to six horse power, both stationary and marine, and can supply the castings, parts and working drawings for the one horse power and two and one-half horse power engines, for experimental purposes and for those who wish to construct their own engines. The accompanying illustration shows the two and a half horse power "Palmer" marine gasoline engine, built on the two cycle compression type, with an impulse at each revolution of the crank. The company also build them on the four cycle type having an impulse every other revolution. These engines are readily adapted to motor carriages and are also used for running printing presses and dynamos for electric lighting. They occupy but little space and consume a small quantity of gasoline or gas.

New York's Population 3,438,899.

An official estimate of the population of Greater New York was given out February 10 by the Health Department as follows: Number of persons in all five boroughs, 3,438,899, of which 1,911,755 are in the borough of Manhattan; 137,075 in the Bronx; 1,197,100 in Brooklyn; 128,042 in Queens and 64,927 in Richmond.

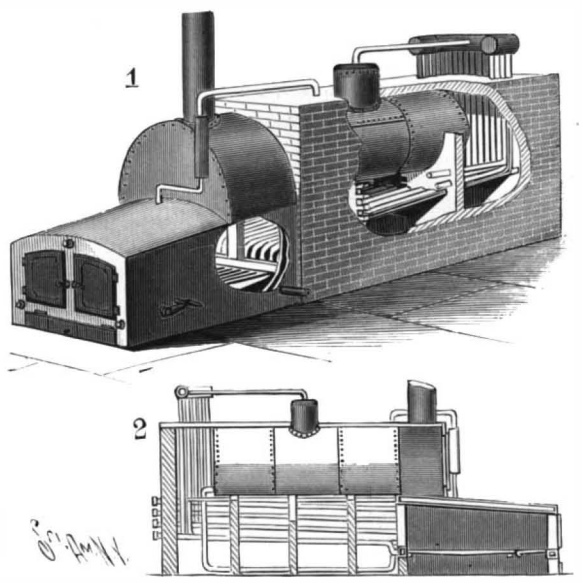
London, by the census of 1891, had 4,231,000 inhabitants, so that New York is about a million less. In 1891 Paris had 2,447,957 inhabitants, while in 1895 Berlin had 1,677,351, then comes Canton with 1,600,000, Vienna with 1,364,548 and Tokio with 1,214,113.

An Inexpensive Garbage Receptacle.

The committee on nuisances of South Park, Dayton, Ohio, is supplying a receptacle for holding garbage and rubbish which is very ingenious. The outside casing is a tile such as is in use for ordinary sewers. It is 18 inches in diameter and 28 inches deep. This tile is set in the ground, the top being about 3 inches above the surface. Into this is fitted a receptacle made of galvanized iron with a substantial bail for the convenience of persons handling the garbage bucket. It is hardly noticeable when the tile is properly inserted in the ground. It is covered by a neat cover. The cost of such a receptacle would be about $1.50.

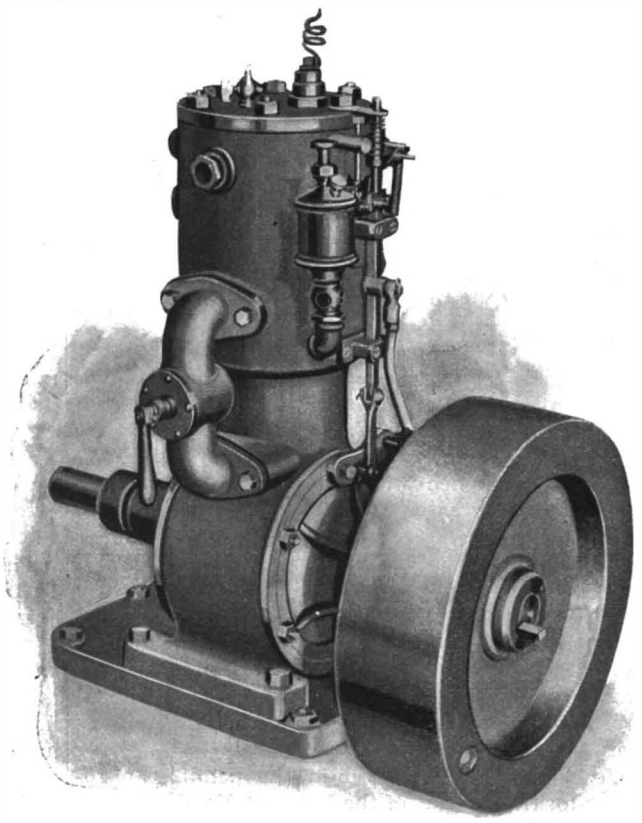
A WATER-JACKETED FURNACE AND BOILER.

The accompanying illustration represents a furnace and boiler in which the furnace is water-jacketed on



INNES' STEAM BOILER.

its sides and top, and special provision is made to insure a perfect circulation and the rapid production of steam. The invention has been patented by Robert W. Innes, of No. 624 North Thirteenth Street, Omaha, Neb. Fig. 1 represents the boiler in perspective, with portions broken out to show the interior, Fig. 2 being a view in section. The fire box has a grate with forward movable section, rocking on a horizontal shaft, whereby it may be dumped by means of a crank at one side, and the top of the fire box water jacket is braced by central water legs at its front and rear, communicating with transverse water beams, the feed pipe entering the water jacket at the rear of the fire box. Extending rearwardly from the water leg and water beam at the rear of the fire box are water tubes which pass beneath and turn up at the rear end of the boiler, to communication with a U-shaped header, these tubes being in the immediate path of the products of combustion, and each tube having a rearward extension, provided with a plug, by removing which the tubes may be blown out. The center of the header



THE "PALMER" MARINE GASOLINE ENGINE.

is connected with the top of the steam dome, and a pipe leading from the forward portion of the boiler at the top is connected with a water column in front of the boiler and thence with the water jacket over the furnace, the column serving to indicate the condition of the water in the boilers. Water tubes also lead from the lower rear portion of the boiler to the water beam at the rear of the fire box. To make tortuous the passage of the gases rearward from the fire box, transverse baffle walls are arranged, each having a break therein, and the breaks being arranged at alternate sides, thus insuring the more perfect combustion of the gases.

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HABITUAL ATTITUDES OF ANIMALS CONSIDERED AS A DEPARTMENT OF COMPARATIVE ZOOLOGY.

BY J. CARTER BEARD.

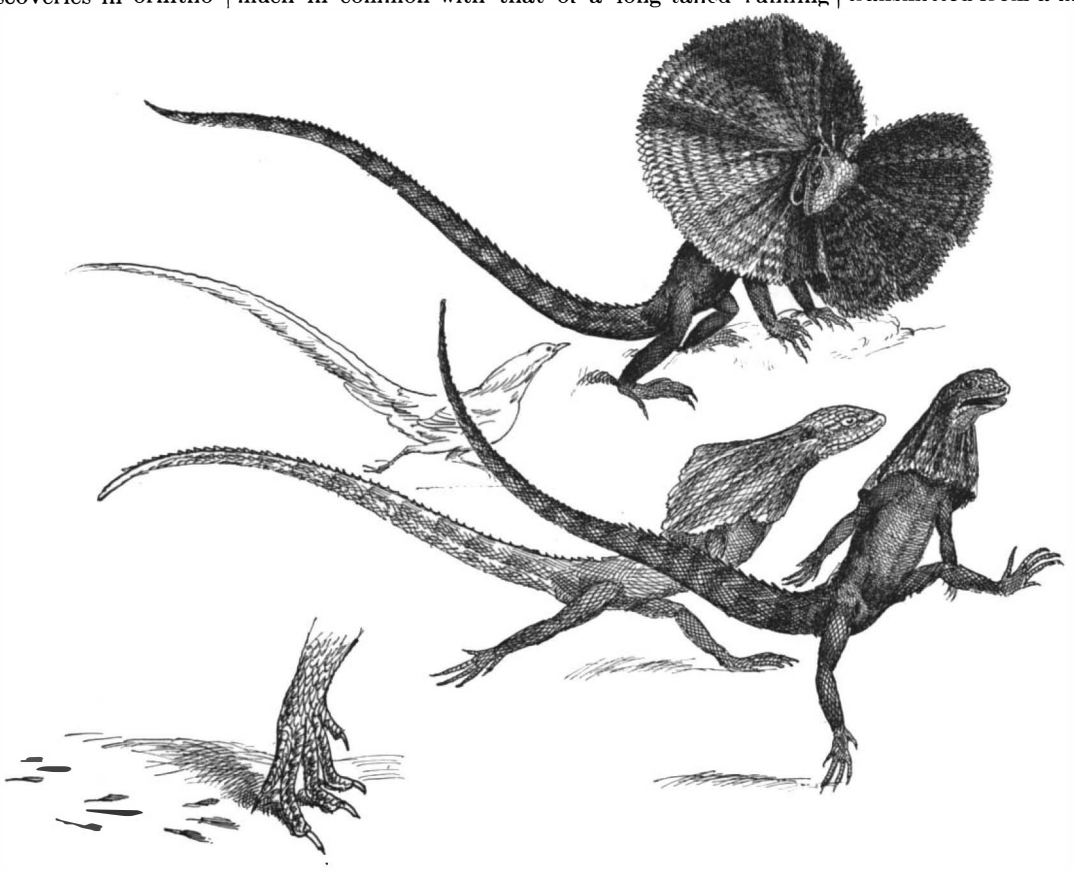
(Continued from page 107.)

One of the most remarkable discoveries in ornithology in late years is that of a feathered quadruped, the crested hoatzin, or Opisthocomus cristatus. This remarkable bird haunts the deepest recesses of the immense forests that extend from the northern seacoast of South America to the Amazon River. The hoatzin is remarkable for possessing, while a nestling, four legs, two of which resemble those of reptiles. The attitudes of the young birds as they leave the nest, which they do at a very early age, and climb over the adjoining limbs and twigs, are far more like those of tree toads than of birds. Mr. J. J. Qwelch, who saw them in British Guiana, writes that, soon after hatching, the well developed claws on the pollax and index are continually used for hooking and holding on surrounding objects, by means of which the nestlings clamber far away from the locality where they were born, following the parent bird at feeding time.

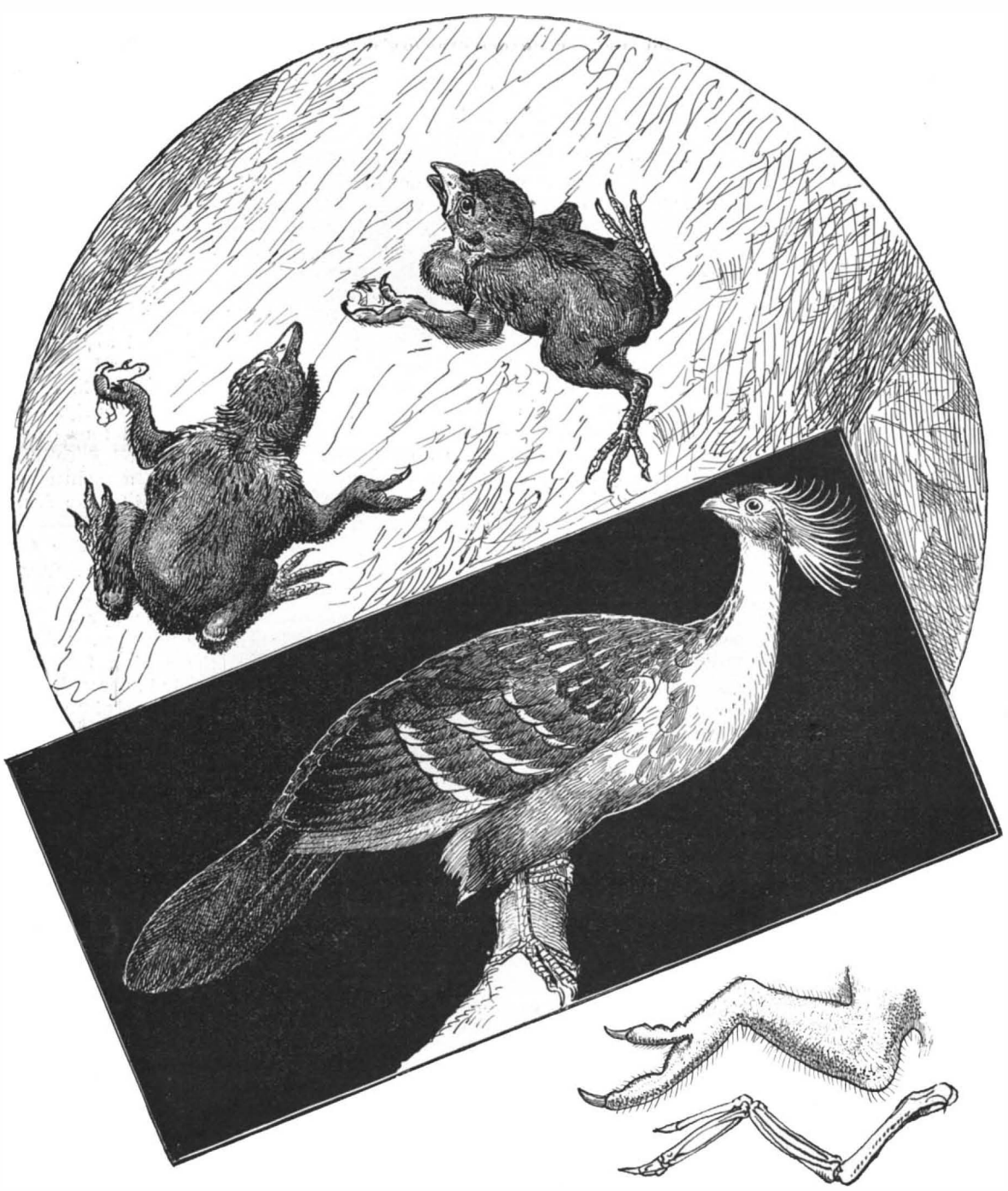
Prof. F. A. Lucas, in an excellent monograph on the subject, says: "The parent birds not only have no claws upon their wings, but their thumbs even are so poorly developed that one would hardly suspect that in the nestlings we have the nearest approach to quadrupeds found among existing birds. Here, then, we have an epitome of development extending elsewhere through uncounted ages compressed into the life history of a single bird, and graphically expressed in the habitual birdlike attitudes assumed by the adult and the unmistakable reptilian character of the clinging, climbing, sprawling quadrupedal postures of the young."

Another instance of the kind must close the article, though it is far enough from exhausting the record. Although the frilled lizard (Chlamydosaurus kingii) yields no indication of the peculiar birdlike modification of the pelvic bones so characteristic of the extinct group of the great reptiles called dinosauria, which, according to the generally accepted interpretation of their anatomy and the evidence of their fossilized tracks, walked upon two legs, as do birds, it gives a lively realization of what a lizard walking upon two legs looks like and helps immensely in conjecturing the appearance of the bipedal saurians when alive.

Mr. W. Saville Kent, in a very interesting communication to Nature, says: "The most remarkable feature exhibited by the specimens I kept in captivity was their peculiar method of running. My last specimens brought from the bush were in vigorous health, and at first trial, when left at liberty, save a light retaining cord, ran along the ground almost perfectly erect, with both their fore limbs and long tails elevated clear of the ground." Attempts were made by means of a Kodak camera to permanently register the absurdly grotesque positions exhibited by these lizards in running, which after several trials were successful. "Although," says Mr. Saville Kent, "these pictures partake much of the character of silhouettes, they will serve to indicate the more characteristic attitudes this lizard may assume in running. The profile of the running reptile is peculiarly interesting, it possesses so much in common with that of a long-tailed running bird, such as a pheasant. One point in particular in the erect running gait of chlamydosaurus invites brief attention. Such is the conformation of the hind foot and its component digits that when thus running only the three central digits rest upon the ground. On account of this peculiarity the track made by this lizard, when passing erect over damp sand or other impressible soil, would be three-toed like that of a bird and would also correspond with such as are left in Mesozoic strata by various typical dinosauria. Whether or not this method of running has been transmitted from a lizardlike dinosaurian, or has been developed independently among its family group, is a question concerning which it would be difficult to pronounce. The phenomenon, while frequent among the reptilia of bygone ages, is, with the exception of chlamydosaurus, extinct among living types;" and the bipedal attitude it assumes is, on that account alone, of unique interest. As may be conjectured from what has gone before, the habitual attitude of animals is a science, in itself as well worthy consideration as any connected with natural history. It has fixed principles and many phases, as the attitudes of animals moved by love or anger, in health and sickness, in action and repose; attitudes common to genera, to families, to classes and those peculiar to species; attitudes of the young as compared with adults, besides many other branches of the subject, all important and doubtless fertile and fruitful upon cultivation, and at the present stage of progress in biological investigation, certainly seeming to demand attention.



FOOT SHOWING HOW THREE-TOED TRACKS ARE MADE BY A FIVE-TOED FOOT.—ATTITUDES OF FRILLED LIZARD AND RESEMBLANCE TO A RUNNING PHEASANT.



YOUNG OF HOATZIN (OPISTHOCOMUS CRISTATUS) SHOWING REPTILIAN ATTITUDES.—ADULT HOATZIN. FORE LIMB OF YOUNG HOATZIN.

Concerning Patent Swindlers.

In our issue of January 29 we alluded to the arrest of a set of patent swindlers. Confirming that report is a letter written to the Commissioner of Patents on January 27 by the Hon. Harrison J. Barrett, Acting Assistant Attorney-General of the Post Office Department, in which the following language is used: "These parties were extensively engaged in swindling patentees in the middle West. Their scheme was, in brief, to address patentees, offering to exploit and sell their patents. Money was first obtained for an abstract of title, and then for commissions, then for journeys here and there to make terms with prospective purchasers, and for any other purpose they chose to name. The abstracts of title were never furnished, the long journeys were never taken, and the prospective purchasers were myths.

"The parties are under indictment at Cincinnati, Ohio, and will be tried for their offense at the March term of the Grand Jury."

It is to be hoped the verdict in this case will be of such a nature as to prevent the continuation of such open frauds on inventors and frighten others from using the United States mails for such purposes.

Ink for Labeling Bottles.

Ink which adheres to glass and takes the place of the paper labels on bottles, etc., is prepared as follows, according to the Werkstatt: Take 20 grammes of brown shellac, which is dissolved in 150 cubic centimeters of lamp spirit; then prepare a solution of 35 grammes of borax in 250 cubic centimeters of distilled water and pour the first solution slowly into the second. Now a dyestuff has to be added to the product received; for this 1 gramme of methyl violet is well suited. The ink prepared in this manner is said to be indestructible.

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Indigo.

BY DR. R. IN TECHNISCHE RUNDSCHAU.

A few weeks ago the German chemical industry was able to record another great success in which science and industry take equal shares. The Aniline and Soda Manufactory of Baden, at Ludwigshafen on the Rhine, has, after years of strenuous endeavors and hard labor, succeeded in discovering a process to produce indigo—the most beautiful and most important of all dyestuffs—from coal tar, in any quantity and at such a low price that it can enter into competition in the world's markets with the natural product. Two figures will suffice to indicate the importance of this invention. Into Germany alone close on to 2,000,000 kilos of indigo were imported in 1896, for which more than 20,000,000 marks were paid to other countries. These figures will explain why chemists have toiled for decades to invent an artificial production of this precious substance, not allowing themselves to become disheartened by the great difficulties or any of the many failures in their work. These statements will justify a closer description of the characteristics of this substance and the conditions under which it is afforded us in nature.

Contained in the sap of various plants is a body called "glycoside," which splits into two others under the action of various agents, such as diluted acids, or by fermentation, viz., into a sugar and into indigo white, which in its turn passes into indigo blue, through absorption of oxygen from the air. While indigo white is rather readily soluble in alkaline fluids, the indigo proper is totally insoluble therein, as well as in most other liquids. On these facts its production as well as its employment are based. Of the plants which contain indigo, only woad is indigenous in our latitudes, whose dried leaves were of great importance in former centuries for blue dyeing. But when in the sixteenth century the importation of indigo from the Orient commenced, it was slowly crowded out, in spite of the resistance of the woad farmers, and even imperial edicts could not save the German woad plantations from decay.

The largest amount of indigo is furnished by East India, where the most important indigo plant, Indigofera tinctoria, is indigenous, but to-day it is also grown in certain parts of Africa and America. In East India the production of indigo and its use in dyeing has been known since the oldest times, and up to the present both have only been changed very little.

Indigofera tinctoria is a herbaceous plant which is annually grown from seed. Before flowering the plant is cut off and steeped, fresh or dried, in water to which a certain amount of lime is added. After some time the liquid starts to ferment; the indigo white, after the splitting of the glycoside, passes into solution, and under the action of the air the insoluble indigo separates from the decanted liquid in the form of a fine blue powder and settles to the bottom. After discharging the supernatant liquid, the moist mass is pressed in moulds, mostly die-shaped, and dried and is thus placed on the market. It is obvious that no pure product can be obtained in this manner, as the impurities of the original liquid get into the precipitate. These impurities are not even always accidental, but are frequently added for adulteration. A further curtailment of the percentage of indigo in the mass is occasioned by the fact that other dyestuffs are contained in the plant, besides the indigo, which precipitate in a like manner. These will cause an alteration of the shade in dyeing, thus causing more difficulties for the dyer. As a matter of fact, a product is frequently found on the market which contains more impurities than dyestuff. Only an accurate chemical analysis can decide the value of a commercial variety, but since a reliable method was lacking up to a short time ago, and as such an examination is even to-day very laborious, and consequently expensive, dyers have become accustomed to judge, in buying, by the outward looks and certain marks, only to become frequently convinced afterward, to their great detriment, that such marks are very deceptive. In order to avoid this uncertainty, one has begun to refine the crude indigo by passing it back into solution as indigo white and precipitating it, after the impurities have settled from the decanted clear solution, by a supply of oxygen. By this process it is possible to remove the larger part of the admixtures and to obtain a pretty uniform product; but by this refinement the price of the dyestuff is considerably raised, and therefore it has not gained much favor.

Like the production of indigo, the process of dyeing with it has remained unchanged in its main points for centuries. The indigo is ground to a dustlike powder in special mills and passed into solution as indigo white by reducing admixtures in a large vat of metal or cement. The solutions of the indigo white are called "vats." Besides the "green vitriol vats" there are still others, according to the reducing agent employed, for the conversion of indigo blue into indigo white. The most suitable is the "hydrosulphite vat," used only of late, which is founded on the action of sodium hydrosulphite and dissolves the indigo promptly after a little stirring.

For cotton, green vitriol is used, which reduces the dyestuff in the cold, i. e., absorbs its oxygen; for wool, the reduction by fermentation, which is obtained by bran and sirup, etc., and by maintaining a uniform temperature of about 30° (C.?), has been found more suitable. In both cases an addition of lime is necessary to keep the indigo white formed in solution. In this solution the loose material, yarn or fabric is moved about until it is completely saturated with it. On being taken out it is, of course, little dyed, but it becomes blue as soon as exposed to the air. The saturation and exposure to air are repeated until the desired shade is obtained. When the vat is exhausted it is refreshed by new additions of dyestuff and lime, etc. It is discharged only when it has become so muddy that sufficiently clear shades can no longer be obtained with it.

This, of course, entails a certain loss of indigo each time, and the dyer strives to defer the discharging as long as possible, which is more practicable the purer the added materials are. The above will explain why a uniform, warranted pure product must be the ardent desire of all dyers. But it has taken a long time till this end was reached.

Above all, it was necessary to throw light upon the intimate structure of this dyestuff. This problem was already solved by the Munich chemist, Prof. Bayer, and in 1881 he succeeded in producing the first artificial indigo. A little later Haumann reached the same result, but in a different manner. From there, however, to a wholesale production in industry was still a wide step. It is true several German manufacturers, in union with the said scientist, were successful in inventing methods which admitted, at least in a limited degree, the use of an artificial indigo in industry. In 1881 the Aniline and Soda Manufactory of Baden placed upon the market a product, the so-called propiolic acid, from which indigo was produced on the fiber in calico printing. A similar product is the indigo salt of the firm of Kalle & Company, at Bieberich on the Rhine. But, outside of the expensiveness, the prints produced with it showed such defects—one of the substances employed had a very unpleasant odor, which could not be removed from the ready product—that a further dissemination was excluded. These drawbacks were finally overcome, in 1895, after a stupendous amount of labor, by the Aniline and Soda Manufactory in their "Indophor," and also by the Hoechst Dye Works, but the improved product was confined to calico printing. An artificial indigo which could compete on the foreign markets with the natural product in all its uses still remained uninvented. As late as 1896 the factory admitted, in one of its pamphlets, that although considerable progress had been made, the end of the laborious path was not yet in sight. As said before, the Aniline and Soda Manufactory has been the first to reach the hotly contested goal. The "How?" is, of course, a deep secret, guarded by the concern, and it is only known that the new indigo is a tar product, and that the success is chiefly based upon the happy choice of the material produced from it, which is at disposal in any quantity. But the manner in which the new product is obtained is immaterial to the dyeing industry, as long as a product is furnished which is always uniform and entirely pure, and the gratification with which this invention is greeted everywhere is sincere.

A Bill to Suppress Fraudulent Advertising.

Another attempt is being made in New York to pass a bill aimed at fraudulent advertising. We reprint the sections of the measure, which are as follows:

"Section 1. Any firm, person or partnership of persons, or any employee of a firm, person or partnership of persons, who, either in the newspapers or other periodicals of this State, or in public advertisements, or in communications intended for a large number of persons, willfully makes or disseminates any statements or assertions of facts with respect to his, her or their business affairs, especially concerning the quantity, the quality, the value, the price, the method of production or manufacture, or the fixing of the prices of his or her or their merchandise or professional work; or the manner or source of purchase of such merchandise, or the possession of awards, prizes or distinctions; or the motive or purpose of a sale, intended to have the appearance of a particularly advantageous offer, which are untrue or calculated to mislead, shall be guilty of a misdemeanor.

"Section 2. Any firm, person or partnership of persons, or any employee of a firm, person or partnership of persons, who, either in the newspapers or other periodicals of this State, or in public advertisements, or in communications intended for a large number of persons, willfully makes or disseminates any statements or assertions of facts with respect to the proprietor or proprietors, manager or managers, practitioner or practitioners of a business or profession; or with respect to the business affairs or professional work of such proprietor or proprietors, manager or managers, practitioner or practitioners, especially concerning the quantity, the quality, the value, the price, the method of production or manufacture, or the fixing of the prices of such merchandise or professional work; or the manner or source of purchase of such merchandise; or the possession by him, her or them of awards, prizes or distinctions; or the motive or purpose of sales, calculated to divert his, her or their trade, or to disturb the carrying on of said business or professional work, or to injure the credit and standing of the proprietor or proprietors, manager or managers, practitioner or practitioners of such business or professional work, which are untrue or calculated to mislead, shall be guilty of a misdemeanor.

"Section 3. This act shall take effect immediately."

Science Notes.

In the fight in the Saran Sar pass in northwest India, a rifle bullet fired by the enemy entered the muzzle of a Sepoy's rifle, penetrating nine inches down the barrel. The Lee-Metford rifle is of 0·303 caliber.

Queen Victoria has decided to convert the old palace at Kew near the Botanic Gardens into a public museum. The state rooms of Kensington Palace, including the famous banqueting hall decorated by Sir Christopher Wren, all of which have been closed and unoccupied since 1760, are to be restored and thrown open to the public.

The following is the reply given by Frederick the Great on January 1, 1786, to the petition of a Silesian factory asking for a monopoly for steel goods: "It is very good that iron and steel should be manufactured in our country; but I should not be willing to have a monopoly, for this always has bad results. The owner of a monopoly does not apply proper attention and diligence to the business, because he has no competitor beside him; the consequence is that he will neglect his work and produce poor goods."—Stahl und Eisen.

In Spain the phonograph is used as a receiver for telephonic messages. One advantage of this arrangement is the facility it offers for repeating messages, since the operator at the transmitting station can hear the message spoken by the phonograph at the same time the operator at the receiving station takes it down. Also messages may be transmitted as fast as desired, and the operator at the receiving station can reproduce them at any time and at lower speed, so that the messages can be readily taken down.—Uhland's Wochenschrift.

A python twenty feet in length, that died in the reptile house of the London Zoological Society recently, was the largest reptile ever confined there. There is a general impression that pythons reach a length of forty feet or more, an absurdity made manifest when the authorities assert that the female Indian python still in the gardens, and but a trifle over eighteen feet long, is the longest snake in captivity of which there is any record. General impressions as to the length of these great reptiles are due to the absurd pictures that formerly decorated geographies and other works used sometimes as text books, showing a picture of a python in the act of crushing and swallowing an Indian buffalo. That was a ridiculous picture that was the father of many of the "freak journalism" pictures of the present day. The London python, which was a real instead of a fabulous reptile, was just over twenty feet in length. It was obtained in Malacca, and was presented to the society by Dr. Hampshire on August 29, 1876, and had, therefore, lived rather more than twenty years in England. During that period it had been fed principally with ducks, of which it sometimes swallowed four or five at one meal. Its food was offered to it once a week, but it sometimes refused to eat for a month together. The specimen will be mounted for the Tring Museum.

The Current Supplement.

The current SUPPLEMENT, No. 1155, contains a number of articles of more than usual interest. The article on "Our Fur Seals" supplements that published in the SCIENTIFIC AMERICAN for January 22 and treats the subject from another point of view and is profusely illustrated. An illustrated article on "Hayti" gives timely information concerning the black republic. "The Progress of Astronomy in 1897" and "Electrical Industry in France During 1897" give an important resumé of the sciences referred to for the last year. Photography is represented by "Hints on the Brush Development of Platinum Prints," and "Bromide Printing," and "A New Basis for Photo-Mechanical Processes," by R. E. Liesegang. Science is represented by a new article on the microphonograph of M. Dussaud and "Visits to Scientific Institutions in Europe," by Prof. Ed. Morley, Ph.D., LL.D., in which he describes visits to various institutions which concern themselves with weights and measures.

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COMMERCE OF THE GREAT LAKES.

The story of the development of trade on the Great American lakes is one of the most remarkable in the wide domain of industrial and commercial activity. In the fourscore years which have elapsed since the inauguration of steam navigation on this great chain of inland seas, the growth of the shipping interests has at all times been constant, and in recent years the increase in the volume of traffic has been truly marvelous. When the settlement of the great Northwest had opened up its vast storehouses of agricultural and mineral wealth, the farmer and the miner found ready to hand in this noble waterway a cheap and easy route for the transportation of their products to Eastern markets.

The growth of the fleet of vessels on the lakes has kept pace with, if it has not anticipated, the growth of the flourishing cities which line their shores, until to-day we are confronted with the curious spectacle of a maritime nation with a seaboard that confronts two oceans for thousands of miles possessing a larger tonnage upon its rivers and lakes than it does upon the high seas.

While it is true that the volume of trade on the lakes is largely due to the advantageous location of this waterway in regard to the natural flow of traffic, much credit is due to the energy with which the facilities of travel have been enhanced by the efforts of the engineer and the capitalist, and by the fostering care of the governments of the United States and Canada. The efforts of the capitalist are manifest in the construction of special types of vessels suited to the requirements of traffic on those inland seas and in the vast and excellently equipped docks and loading facilities which abound at all principal points. The hand of the government is seen in the deepening of channels, the improvement of harbors and the construction of canals where natural obstacles limit or absolutely prevent the passage of vessels.

The most noted work of improvement by the government is that which has been carried out at Sault Sainte Marie, or the Rapids of St. Mary's River. St. Mary's River is the natural outlet by which Lake Superior discharges into Lake Huron, and near its head are situated the famous Sault or falls from which the thriving American city takes its name. The total fall of the river is some 18 or 19 feet in a distance of half a mile, and while the obstruction furnishes a valuable source of water power, it absolutely prevents navigation.

The first ship canal around the rapids was built by the State of Michigan, in 1853 to 1855. It served at once to stimulate trade upon the upper lakes, and in view of its great economic results, especially in the Lake Superior regions, and the enormous traffic which it has handled in its time, it will always rank as having been one of the most important canals in the world. It was 350 feet in length and contained two locks, the total cost of the undertaking being in the neighborhood of $100,000.

The rapid development of the Lake Superior country and the consequent increase in the shipping interests soon exceeded the capacity of the canal and enlargement became necessary. The Federal government accordingly took the canal under its control, and superseded it in 1881 by a larger structure. The new canal was given liberal dimensions, the single lock being 515 feet in length, with a width of 60 feet at the gates and 80 feet in the chamber, the depth over the sills being 14 feet. The total cost of the canal was $2,150,000.

Although the opening of the second canal relieved the congestion, the relief was only temporary; for, great as the increase in tonnage passing through had been during the period from 1855 to 1881, the growth of traffic was even more rapid during the next decade. In 1870, when the old canal had been opened 15 years, the total tonnage was some 691,000 tons, among which was about 50,000 bushels of wheat; but, in 1894, when a third canal was built, parallel to the first government structure, the total tonnage had risen to 13,110,366 tons, in which was included 34,896,483 bushels of wheat. This was a greater tonnage than that passing through the Suez Canal, although the latter is open the whole year and the Sault Sainte Marie locks were open for only eight months. The new lock on the American side is a very imposing structure. The chamber is 800 feet long, with a width of 100 feet. The walls measure 44 feet in height from the floor, and the total length of the masonry over all is 10,010 feet. The depth over the sills is 20 feet 3 inches, sufficient to accommodate lake vessels with a tonnage rivaling that of the large ocean freighters.

In 1888 the Canadian government passed a bill authorizing the construction of a canal on the Canadian side of the river. A contract was let for a canal which was to be 600 feet long between gates, 60 feet wide at the gates, with a depth of 16 feet; but before much work had been done, and in view of the fact that the draught and length of lake vessels was increasing so rapidly, it was decided to increase the dimensions to those upon which the canal was finally built. The present structure is 900 feet long between gates, 60 feet wide at the gates and the depth over the sills is 20 feet 3 inches. The width of the chamber is 60 feet. Compared with the American lock, it will be seen that it has the same depth, but is 40 feet narrower. The capacity of the lock was shown when three steamers of the Minnesota Steamship Line, with a combined length of 936 feet and registered tonnage of nearly 5,000 tons, were put through at one locking.

The tonnage passing through the American canals, during the eight months of the year 1896, was 17,249,418 tons, whereas the total amount passing through the Suez Canal in the whole twelve months of the same year was but 8,594,307 tons, or less than one half as much. The mean tonnage of the lake vessels was 927, as against a mean tonnage of 2,788 for those passing through the Suez Canal. Of course it will be understood that the Suez Canal ships are on long voyages, and many of them pass the canal only once in a year, whereas the lake ships will some of them pass the canals from forty to fifty times in a year. The figures for the two canals show the actual tonnage passing through, and are not an indication of the total number of ships employed. Thus the "Soo" traffic was represented by 18,618 lockings, and the Suez traffic by 3,047 passages of the canal. Of the total registration through the American canals, 4,391 were sailing vessels and 13,404 were steamers.

An analysis of the traffic shows that 37,066 passengers passed through, and the figures for the leading items of freight were: Iron ore, 7,909,250 tons; coal, 3,023,340 tons; wheat, 63,256,463 bushels; other cereals, 27,448,071 bushels; flour, 8,882,858 barrels; lumber, 684,986,000 B. M.; pig iron, 121,872 tons; copper, 116,873 tons; salt, 237,515 tons. The total value of the freight was $195,146,842 and the value of the fleet that carried it is estimated at $43,000,200.

Duluth is, by virtue of its geographical position and its vast and evergrowing trade, the Chicago of the Northwest, and the vast amount of trade that seeks this city as being the most westerly shipping point on the lakes has caused it to grow in a few years to a leading position among the great ports of the world. On the front page of this issue will be found illustrations of the grain elevators, the ore docks and the city itself. The ore docks, of which there are two, were constructed at a cost of $860,021, and have a capacity of 92,160 tons. They are typical of the great system of ore docks that is to be found on the shores of Lakes Superior and Michigan. It is estimated that the combined capacity of these docks on the two lakes is 633,804 tons, and their special loading facilities are such that a 5,000 ton vessel can be loaded in the space of a few hours. The total capital invested in mines, railways, docks, etc., concerned in the mineral traffic of this region is approximately $240,000,000. The entire commerce of the Great Lakes is estimated to amount to between 32,000,000 and 34,000,000 tons, and in the successful endeavor to encourage this traffic by deepening harbors and channels and improving and protecting waterways, the government has expended some $281,000,000.

The necessities of the lake traffic have produced a special type of cargo steamer which is a compromise between the barge and the ocean freight steamer. Of recent years a remarkable fleet of these large ships has been launched and it is growing rapidly both in numbers and the size of its individual boats. Among these are such vessels as the "Bessemer," 432 feet long by 48 feet beam and 28 feet draught; the "A. Carnegie," about the same dimensions, which has carried as much as 5,586 tons of grain on a single trip. The later ships show a continued tendency to increased size and tonnage.

These boats have the engine room and boilers located at the stern, and devote the unbroken length of the body of the ship to cargo. The whaleback is another distinctive type which has been evolved by the lake ship builders, and a large fleet of them has already been turned out of the Duluth yards. In our illustrations the whaleback type is shown in the engraving of Duluth ore docks, where three of these vessels are to be seen alongside the ore pockets, and in the engraving of the "Christopher Columbus," a passenger whaleback which was familiar to visitors to the World's Fair. The latter ship is a beautifully modeled vessel, 362 feet in length, with a beam of 42 feet and of high speed.

Two other famous passenger vessels are the "North Land" and the "North West," of 4,244 gross tonnage, 7,000 horse power, and a speed of 21 miles an hour. They ply between Buffalo and Duluth, and carry their passengers at a speed and amid luxurious accommodations that rival those of the great Atlantic liners.

In conclusion it should be mentioned that this truly wonderful traffic is carried on at a surprisingly low rate per ton. For the ten years 1886 to 1896, the average cost was 1·35 cents per ton per mile. For the three years 1893 to 1896 the rate has been 0·99 cent, or say one cent per ton.

The significance of the figures which have been given is only realized when it is borne in mind that the first ore was shipped but forty-two years ago, and that the bulk of the lake trade is the growth of less than half a century.

The Perfected Joly Color Process.

This process invented some time ago by Prof. J. Joly, of Dublin, Ireland, has been improved upon and perfected in this country so that it is now commercially practical, and is being introduced by a company styled "The Joly-Sambra Company," of Montclair, N. J. At the Camera Club, of this city, on the 7th instant, Prof. J. S. Gibson showed through the lantern several interesting natural color photographs, made by this process, and remarked that film plates and other things needful for the practical utilization of the process were now to be obtained.

The essential feature of the process, as is well known, is founded upon the combination of the three primary colors, red, blue and green; but, instead of having three red, blue and green separate pictures merged into one, as has been customary, Joly prepares a single glass plate, with a series of triple parallel colored lines on the surface, separated only the $\frac{1}{225}$ of an inch apart; that is, a red line, a blue line, a green line, then a red, blue and green, one after the other, respectively, until the whole plate is covered. This is the key of the process. A special plate of this kind is called the taking screen, and is used by placing it in a plate-holder having a hinged back, with the ruled or film side upward and in close contact with the film of a panchromatic sensitive dry plate, that is, a plate universally sensitive to colors.

This company recommends the Cadett panchromatic plate. The holder, with the two plates, is next inserted in the camera, and what is called an orthochromatic light filter, or intercepter, consisting of a sheet of glass, coated with a delicate yellow film for the purpose of checking the too rapid action of the violet rays, is placed in the camera just back of the lens. The diaphragm aperture is varied according to the subject and intensity of light, but the most effective is f/6 down to f/16, and the exposure may be varied from three seconds to $\frac{1}{17}$ of a second.

The exposed plate is next developed in the usual way, but, on account of the character of the plate, development must be begun in almost total darkness and carried on in very deep, feeble ruby light. After fixing, the plate is washed for one or two hours and is a perfect monochrome negative, in which the reduced silver deposit is proportional to the color value of the objects photographed, and contains numerous minute lines $\frac{1}{225}$ of an inch apart, as were in the original taking screen.

From this monochromatic negative a positive is made by contact on an ordinary slow emulsion lantern slide plate developed not quite as far as the negative. After fixing and washing, this monochrome transparency is very slowly dried in a damp closet; twenty-four hours for drying being recommended, in order that the shrinkage of the gelatine film may be uniformly even and the lines of the transparency coincide precisely with the lines of the taking screen.

It is evident any number of these transparencies may be made from one negative, so that the number of natural color duplicates is not limited.

Having secured the transparency, the final step is to cover it with the ruled red, green and blue cover glass, film side in contact with the film of the transparency, and adjust it so that the lines of the cover glass correspond or overlap exactly the lines in the transparency. When that is done the two glasses are bound together with gummed paper, and the result is a beautiful photograph viewed by transmitted light in all the natural tints, colors and gradations of nature. The various false and curious colors obtainable by slightly moving to the right or the left the ruled cover glass over the picture are very interesting and remarkable. Some may object to the obtrusiveness of the lines, but if a lantern slide of this character is held distant from the eye two feet away, the lines merge with the rest of the picture and are not observed.

At the lecture colored slides of different subjects were thrown on the screen in size about six feet square, which naturally magnified the lines proportionately. In some classes of pictures they were too prominent, in others they produced no unpleasant effect. Among them was a picture of a United States flag showing the red and blue very effectively. In a portrait of large size, taken in about two seconds, the natural color of the skin, hair necktie and the rose in the buttonhole of the lapel, were very effective. A portrait of a blanketed horse drinking from a water trough, taken in $\frac{1}{17}$ of a second, was especially good, the different colors of the stripes of the blanket being perfectly reproduced. A bouquet of pink roses in a blue vase was quite interesting.

We have no doubt but what the process will prove of great interest and value to amateur photographers, as only a few simple precautions are needed to secure beautiful effects, and it is a satisfaction to note that the practical perfection of the process is due to the ingenuity and perseverance of Americans.

FOR half an hour 31·9 knots was the rate of speed of the "Star," a new 30-knot torpedo boat destroyer built by the Palmers. The average for the three hour trial was 30·68 knots.

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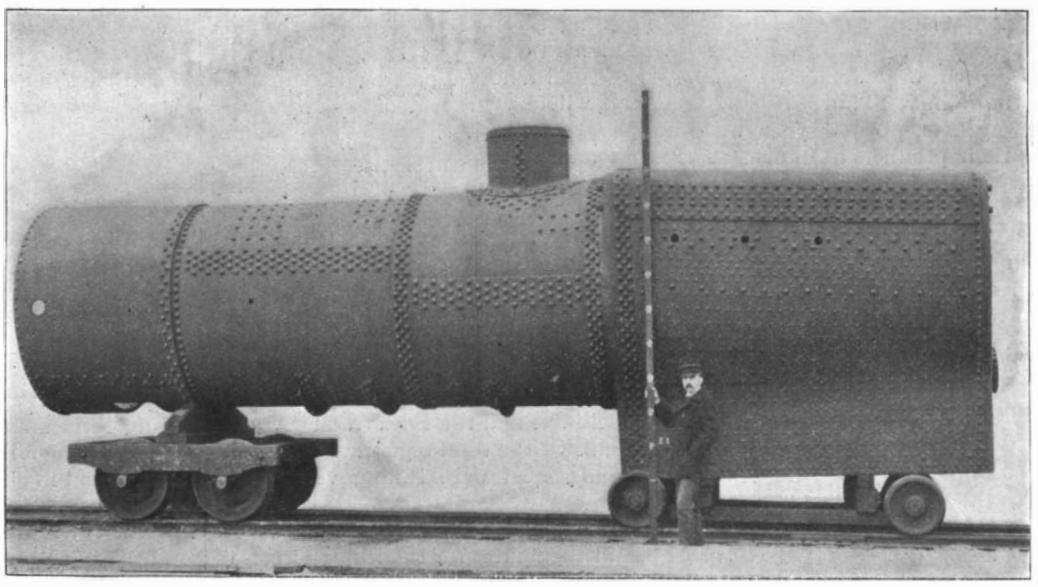
THE LARGEST LOCOMOTIVE EVER CONSTRUCTED.

We give two illustrations of what is undoubtedly in all respects the largest locomotive in the world. It is one of two which have been built by the Brooks Locomotive Works for the Great Northern Railway, for the purpose of hauling heavy trains over the mountain division of that road. The giant proportions of this machine are evident at a glance by comparing its various parts with the figures which are shown in the photographs. We have from time to time illustrated the most powerful locomotives as they were put in service, the most notable of which of recent date are the Decapod freight locomotive for the New York, Lake Erie and Western Railway, illustrated in the SCIENTIFIC AMERICAN July 15, 1896; the twelve-wheel locomotive for the Northern Pacific, illustrated in our issue of April 24, 1897; and a special mountain locomotive for the Mexican Central. The particulars of these engines are shown in tabulated form below, and they afford an interesting comparison with the powerful machine which is the subject of the present article.



BOILER FOR THE GREAT NORTHERN LOCOMOTIVE.

Largest diameter, 87⅛ inches; heating surface, 3,280 square feet.

Of these engines, there is only one whose total weight on drivers is equal to that of the Great Northern engine. This is the powerful Decapod, owned by the New York, Lake Erie and Western Railroad, the total weight on drivers in both cases being 172,000 pounds. The weight on the first pair of drivers of the Great Northern engine is 42,000 pounds; on the second pair, 45,000 pounds; on the third, 43,000 pounds; and on the fourth pair of drivers, 42,000 pounds. In addition to this there is a load of 20,375 pounds on each pair of truck wheels, the total weight of the whole engine being 212,750 pounds, this being the first time that a locomotive of the standard type has been built which exceeded 100 tons. The total weight of the engine and tender is 308,750 pounds. The boiler, of which we give a separate view, is of enormous size and capacity. Its outside diameter is 78 inches in the smallest ring and 87⅛ inches at the largest part. The heating surface is 3,280 square feet, the grate area being 34 square feet and the firebox heating surface 235 square feet. It is of the Belpaire pattern, and the working steam pressure is 210 pounds a square inch.

The cylinders, as may be imagined, are of unprecedented size, the diameter being 21 inches and the stroke 34 inches. This is the longest stroke ever used on a locomotive, with possibly one exception, in the case of an engine built many years ago at the Sacramento shops of the Southern Pacific Railroad Company, and named, we believe, "El Gobernador." The driving wheels are 55 inches in diameter, and this combination, under the working pressure of 210 pounds of steam, gives a tractive effort of 46,300 pounds. That is to say, when the engine is working up to its full power the pull on the drawbar is 23 tons. This would suffice to haul a train weighing 7,700 tons over a level road. The valves are of the piston type and balanced; they are 16 inches in diameter, or as large as the pistons of many passenger engines which are still in active service. The dimensions of the various working parts are all large in proportion. Thus the piston rods are 4½ inches in diameter; the journals of the driving axles measure 9 by 11 inches; the main rod bearing measures 6½ by 6½ inches, and the side rod bearings 7⅜ by 5 inches. The piston rods, crank pins and crosshead pins are of high grade open hearth steel, and the piston rods and crosshead pins are made hollow. The driving wheel centers, engine truck wheel centers, driving boxes, driving box saddles, spring fulcrums, pistons, front and back cylinder heads, crossheads and guide yoke ends are of cast steel; the cylinder head casings, smokebox front and door, smokestack base, dome casing and sandbox casing are of pressed steel. Special attention has been given to the design of the engine frame, which is made exceptionally heavy. It is forged solid and measures 5 by 5 inches at the jaws and it is 4 inches deep elsewhere at the top, the bottom bar being 3¼ inches thick at the jaws and 2½ inches thick between jaws.

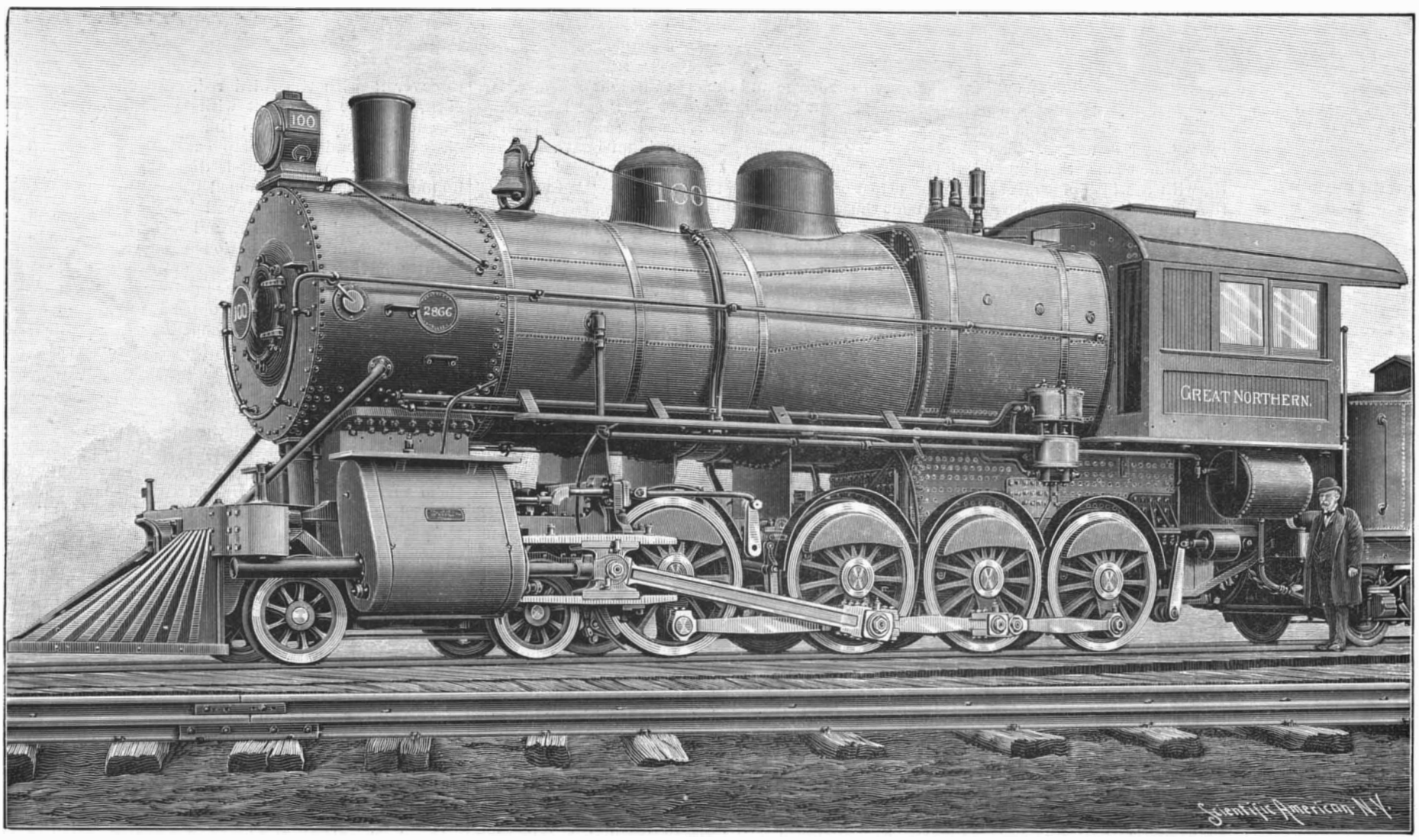
As the engines are to be used on mountain work, where the temperature is often extremely low, special care has been given to the lagging of the boiler, steam chests, cylinders, etc., the material used being Sal Mountain asbestos. Altogether the engine, despite its vast size, has a trim and well proportioned appearance that is particularly pleasing to the eye.

Since writing the above we learn that the exact stroke of "El Gobernador" was 36 inches. An even larger stroke was used on some curious experimental express engines built in 1848 for the Camden and Amboy road. These had single 8-foot drivers and 14 by 38-inch cylinders.

We are informed by the builders that in a recent test by the Great Northern Company 32 loaded cars, weighing in all 1,070 tons, were drawn by one of these engines up a grade of 87 feet to the mile, upon which was a 4-degree curve. The combined resistance of grade and curve renders this a very remarkable performance.

At a speed of slightly over 20 miles an hour, with a cut-off of 50 per cent, the engine indicates 2,640 horse power.

	Twelve-wheel locomotive, Gt. Northern.	Special mountain engine, Mexican Central	Twelve-wheel locomotive Nor. Pacific.	Decapod, New York, Lake Erie & Western.
Weight on drivers, lb.	172,000	145.200	150,000	172,000
" " trucks	40,750	F. 23,450 / B. 24,800	36,000	23.000
" total	212,750	193,450	186,000	195,000
Length over all, engine.	41 ft. 4 in.	36 ft. 6¾ in.	.....	.....
Heating surface, firebox	235 sq. ft.	218·0 sq. ft.	205·5 sq. ft.	234·3 sq. ft.
" " tubes	3,045 sq. ft.	2,585·0 sq. ft.	2,736·9 sq. ft.	2,208·8 sq. ft.
" " total	3,280 sq. ft.	2,803 sq. ft.	2,943·4 sq. ft.	2,443·1 sq. ft.
Grate area	34 sq ft.	31·45 sq. ft.	35·0 sq. ft.	39·5 sq ft.
Drivers, diam	55 in.	49 in.	55 in.	50 in.
Cylinders, diam	21 in.	21 in.	23 and 34 in.	16 and 27 in.
" stroke	34 in.	26 in.	30 in.	28 in.
Boiler, type	Belpaire	Belpaire wagon top	Extended wagon top.	Straight
Working steam pressure, lb. per sq. in.	210	180	200	180
Boiler, outside diam. barrel	78 in.	78 in.	72 in.	76 in.
Firebox, length	10 ft 4 in.	10 ft. 1 in.	10 ft. 3-16 in.	10 ft. 11⅛ in.
" width	3 ft. 4⅛ in.	3 ft. 2½ in.	3 ft. 6 in.	8 ft. 2⅛ in.
" depth front	86½ in.	82 in.	77 in.	.....
" " back	79 in.	75 in.	73½ in.	.....
Tubes, number	376	412	332	354
" outside diam	2¼ in.	2 in.	2¼ in.	2 in.



THE LARGEST LOCOMOTIVE EVER CONSTRUCTED.

Cylinders, 21×34 inches; steam pressure, 210 pounds; weight, 212,750 pounds; horse power, 2,640; drawbar pull, 23 tons; hauling capacity, 7,700 tons on level.

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DONATELLO'S EQUESTRIAN STATUE AT PADUA.

Donato di Niccolò di Betto Bardi, commonly called Donatello, is one of the most dignified and impressive figures of the early Renaissance. It is to this Florentine sculptor (1386-1466) that we owe not only the first great equestrian statue of the Renaissance, but in connection with Michelozzi he created the mausoleum of the fifteenth century, which was so potent a factor in the development of fifteenth century sculpture.

We can hardly realize the difficulty which confronted Donatello when he received the commission for the equestrian statue of the famous condottiere Erasmo da Narni, called "Gattamelata."

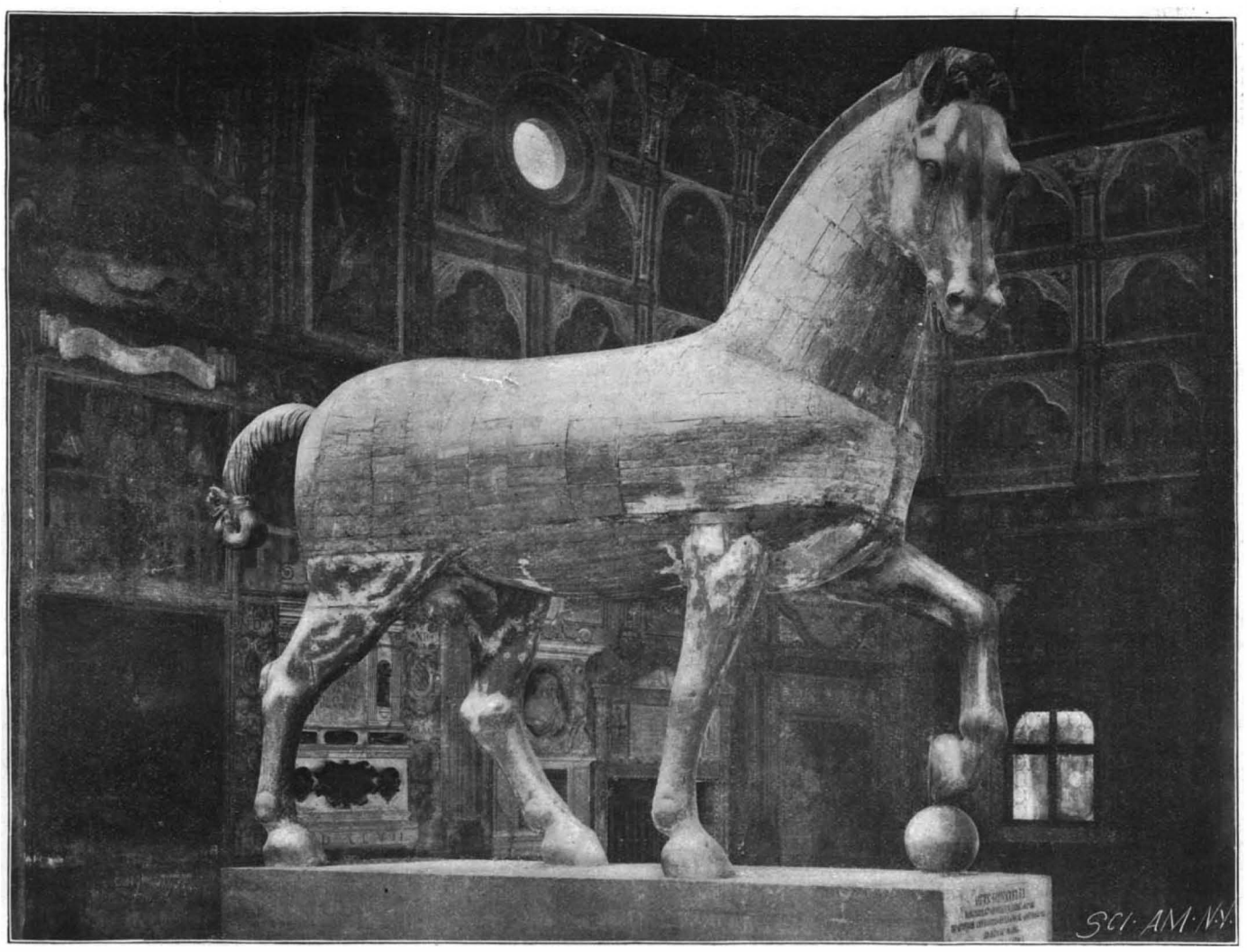
The execution of the statue of this mounted warrior was remarkable, as it was the first that had been attempted since the days of antiquity. It was an enterprise as considerable as the construction of the cupola of the cathedral of Florence, by his friend Brunelleschi. In both cases the artists were bold innovators, having to work out not only the design, but also the technical details connected with its execution, for cupola building and bronze casting were not everyday occurrences among the Florentines.

Donatello had probably never seen more than one or two statues of horses, the Marcus Aurelius, now on the Campidoglio, at Rome, and the bronze horses of St. Mark's, at Venice, and possibly a few Gothic or semi-Gothic statues. He was obliged to work out for himself a new system of equine anatomy, a science which had been neglected for centuries.

It is a great art to mount a bronze or marble rider on his steed so that the effect will be monumental. Equestrian effigies had before daunted great sculptors, even Jacopo della Quercia, but Donatello went bravely to work on his problem, and after making the wooden model shown in our engraving, the bronze group was cast and set up on its pedestal under the walls of San Antonio, at Padua. It has become the very incarnation of the condottiere, the captain of mercenaries, and the soldier of fortune is more celebrated in his death by the enduring bronze than in life by his exploits.

The "Gattamelata," with the "Colleone," at Venice, form the most interesting pair of equestrian statues that the Renaissance has produced. The warhorse in the Gattamelata is ponderous and suggests a portrait almost as much as his rider. Vasari says: "The chafing and neighing of the horse are made clearly obvious." Solidly settled on an ornate saddle sits the rider with bare head, one hand grasping the reins while the other holds the bâton of command. He is clad in armor, and both it and the saddle seem to have come in for that painstaking care which is so characteristic of the Renaissance, and, in fact, of all good periods of art. The charming little naked figures at each end of the saddle would almost give celebrity in themselves to a collection. The head of the rider is a magnificent study in portrait sculpture, and it shows us the condottiere who was prudent rather than rash, like the rider of that other bronze horse in nearby Venice. The pedestal has two bronze bass-reliefs, with genii which hold a cartouche surmounted by a casque, the crest of which is ornamented by a cat—the arms of the Gattamelata. The reliefs have now been taken to the great church of Padua, St. Antonio, or "Il Santo" as it is called, and modern copies have been substituted for them. The Gattamelata cost about $33,000 of our money—a large sum for the time. We have an interesting souvenir of Donatello's struggles in the matter of the Gattamelata in the wooden model of a horse which stands in the Palazzo della Ragione, at Padua, a building more remarkable for its great size than for its architecture. Donatello received his commission in 1444 and in 1453 the casting and chiseling were completed. The wooden horse seems to have been modeled after the famous bronze horses on the façade of the basilica of San Marco, at Venice. It is composed of many pieces ingeniously fitted together, so that it looks like the horse of Troy. At some public games given at Padua by Count Capodalista it was covered with skins and bore a gigantic Jupiter upon its back. The poet Lazzarelli lauded it as superior to any work of Dædalus, Phidias or Praxiteles, and even modern connoisseurs are divided upon the merits of the bronze horse and its wooden prototype. It is certain that in some respects the model is superior, notwithstanding the unworthiness of the material. The head is, however, a restoration. There is a full size plaster model of the Gattamelata in the Metropolitan Museum, New York. It is injured, however, by being placed directly under a ceiling. Its value would be greatly enhanced by bringing it out to the large hall.

DONATELLO'S EQUESTRIAN STATUE "GATTAMELATA" AT PADUA.



WOODEN MODEL FOR THE "GATTAMELATA" PALAZZO DELLA RAGIONE PADUA.

The Vitality of Seeds.

A very interesting meeting took place recently at the Chemical Society, when Mr. Horace Brown delivered an address on the vitality of seeds that had been exposed to very low temperatures for a considerable time. The late Prof. G. T. Romanes had already shown that seeds could be kept in an almost complete vacuum for a year or more without undergoing any deterioration in their germinating properties. A later worker also adopted the ingenious device of sealing up seeds in Geissler tubes for a long period, when, on subsequently passing a spark, no glow due to incandescent carbonic acid gas or nitrogen was observed, thus proving that the seeds do not exhale either of these gases when kept. Mr. Brown, in conjunction with Prof. Dewar, has maintained seeds at the temperature of liquid air (180 deg. C.) for a continuous period of 110 hours. On subsequently carefully thawing the seeds and testing them, they were found to be completely unaffected. They germinated quite as freely as other test seeds which had not been so treated, and, in fact, no difference in their behavior could be detected.

SUCCI, who recently completed his sixty-fourth public fast in Rome, has abstained from food in his performances for 2,500 days of his life—nearly seven years.

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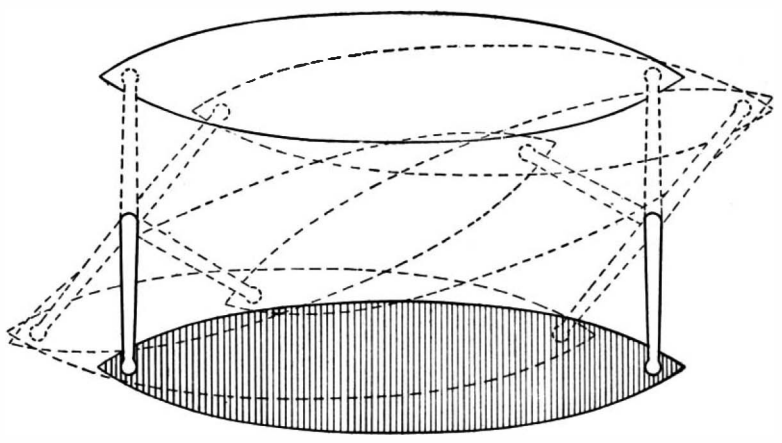
The Typewriter and Health.

The typewriter has won its way so completely wherever much writing is done that any evidence of the influence which it may exert upon health deserves attention. The Phonetic Journal publishes a note from a correspondent who, in response to the question, "Has anyone ever known of a genuine case of typewriters' cramp induced in a normal constitution by the use of any standard machine?" replies that he suffers from cramp so produced and has heard of two other cases. The Phonetic Journal was in the first instance disposed to doubt the existence of typewriters' cramp, but admits that the case of its correspondent is a genuine example of the affection. Typewriters' cramp belongs to what Dr. Poore calls the professional impotencies, and its occurrence after the nimble, oft-repeated movements of the typewriter's hand and fingers is a thing no more to be wondered at than pianists' cramp, compositors' cramp or tailors' cramp. In the course of time it is but too probable that typewriters' cramp will become, if not as well known, at least as recognizable as ordinary writers' cramp. But if the spread of the typewriter brings to its user the risk of cramp, there is, if an American journal is to be believed, a balance of advantage to be set down in its favor. "The death-dealing corset," we are told, "has found in the typewriting machine and the bicycle two implacable foes." No expert can manage either the typewriter or the bicycle while she is held in "a close-fitting cage of whalebone and steel." If the wheel and the typewriter have done much for woman, not the least of the blessings they may bring is in helping to set her free from what The New Education describes as "the cramping, uncomfortable, health-destroying, ugly, and barbarous mediæval invention called the corset." This is vigorous language, but if the contention is good and capable of proof, then the influence of the typewriter on the health of at least the female section of those who use it must, in spite of the risk of typewriters' cramp, be regarded as beneficial.—Lancet.

THE McKINNON AUTOMATIC BOAT-LAUNCHING DEVICE.

Next in importance to the provision of a sufficient number of lifeboats on an ocean passenger ship is the arrangement of some speedy and safe means of launching them. To anyone who has watched the boat drill on any of the Atlantic liners, it is evident that the process is slow, and might be full of risk when carried out in the panic of a sinking or burning ship. The records of marine disaster, indeed, show that a certain and not inconsiderable proportion of the fatalities are due to delay and accident in launching the boats. The ordinary means of launching consist of independent hoisting tackles, at each end of the boat, the slack of which is coiled up within the boats. When a boat load of passengers is to be launched, each tackle is handled by one or more men, who endeavor to lower away so that the boat shall be kept on an even keel. This is, or seems to be, a difficult matter to accomplish. In their haste, the crew frequently fail to keep the boat level; one end is allowed to run down faster than the other, with the result that the passengers are spilled into the sea or the boat is swamped. This was what occurred at the wreck of the "Elbe," and the blunder had to answer for many of the lives lost on that occasion.



1.—DIAGRAM OF MOVEMENTS OF DAVITS.

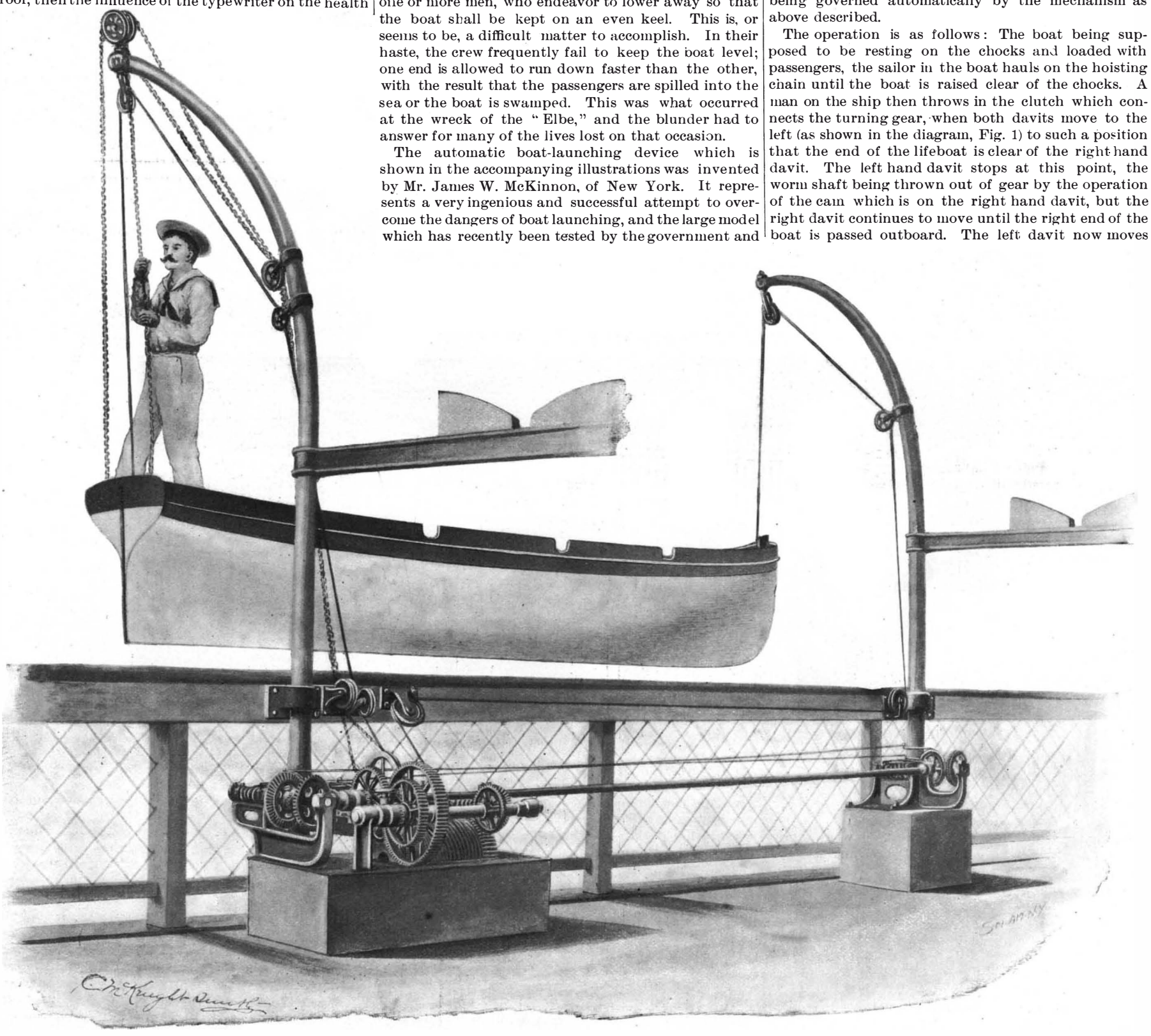
The automatic boat-launching device which is shown in the accompanying illustrations was invented by Mr. James W. McKinnon, of New York. It represents a very ingenious and successful attempt to overcome the dangers of boat launching, and the large model which has recently been tested by the government and by the officers of the Atlantic steamship lines, at the Brooklyn Navy Yard, has given great satisfaction.

The boat is hoisted and lowered by two steel ropes which are fastened to ring bolts at the bow and stern, and lead through sheaves at the head and near the foot of the davits to a hoisting drum located at the foot of the left hand davit, looking outboard. The two ropes being wound upon a common drum, the boat is at all times maintained on an even keel. The movements of the davits in swinging the boats outboard are controlled by worm gears which are keyed to the davits as shown in Fig. 4. The swinging movements are not always in the same direction, as in passing the boats between the davits it is necessary at certain points to reverse or stop the motion. These movements are accomplished by bevel gears and clutches, which are thrown in and out of gear at the proper moment by means of cams on the worm gears and rods connecting the cams with the clutches.

The hoisting and turning gear is operated by means of an endless chain, which passes over sheaves on the right hand davit and drives a sprocket wheel shaft above the hoisting drum. At each end of the shaft is a bevel gear which meshes with a pair of loose gears on the worm shafts. The worm shafts and the worm wheels at the base of the davits are driven in either direction according as one or the other of the loose bevel wheels is engaged by the clutches, and the movement of the clutches is controlled by the cams on the worm wheels.

The drum is driven by a worm and gear, operated through a countershaft, which is thrown in and out of gear by a clutch on the latter. After this clutch has been thrown in the whole operation is performed by the man in the boat, the various motions of the two davits and the lowering of the boat on an even keel being governed automatically by the mechanism as above described.

The operation is as follows: The boat being supposed to be resting on the chocks and loaded with passengers, the sailor in the boat hauls on the hoisting chain until the boat is raised clear of the chocks. A man on the ship then throws in the clutch which connects the turning gear, when both davits move to the left (as shown in the diagram, Fig. 1) to such a position that the end of the lifeboat is clear of the right hand davit. The left hand davit stops at this point, the worm shaft being thrown out of gear by the operation of the cam which is on the right hand davit, but the right davit continues to move until the right end of the boat is passed outboard. The left davit now moves



2.—AUTOMATIC LIFE-SAVING DAVIT DEVICE—LIFEBOAT BEING SWUNG OUTBOARD BY ONE MAN.

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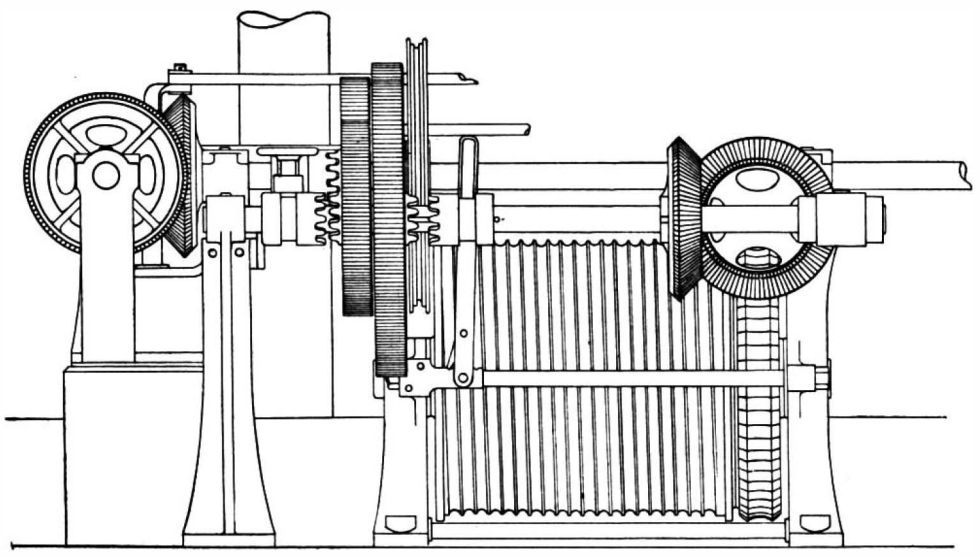
again, the right continuing to move also until both davits are at an acute angle to the side of the ship. The right davit stops at this point and the left continues to move to a position parallel with the right, when both move in unison and come to rest in the outboard position or at right angles to the axis of the ship. The operator in the boat now pulls on the chain, which is long enough to reach to the water, and lowers the boat, which, as already explained, is certain to strike the water on an even keel. It should be mentioned that one man operating the chain can raise and lower a boat load weighing four tons with ease.

An improvement on the mechanism here shown is being made with a view to enabling the whole operation to be carried out from the boat, thereby doing away with the necessity of a man remaining on the ship to throw in the turning gear clutch. The time consumed in transferring the boat from the chocks to the water on the occasion of the recent test at the navy yard was eighty seconds, which is considerably shorter, it is needless to say, than the time consumed by the present methods.



3.—ELEVATION OF HOISTING AND TURNING GEAR.

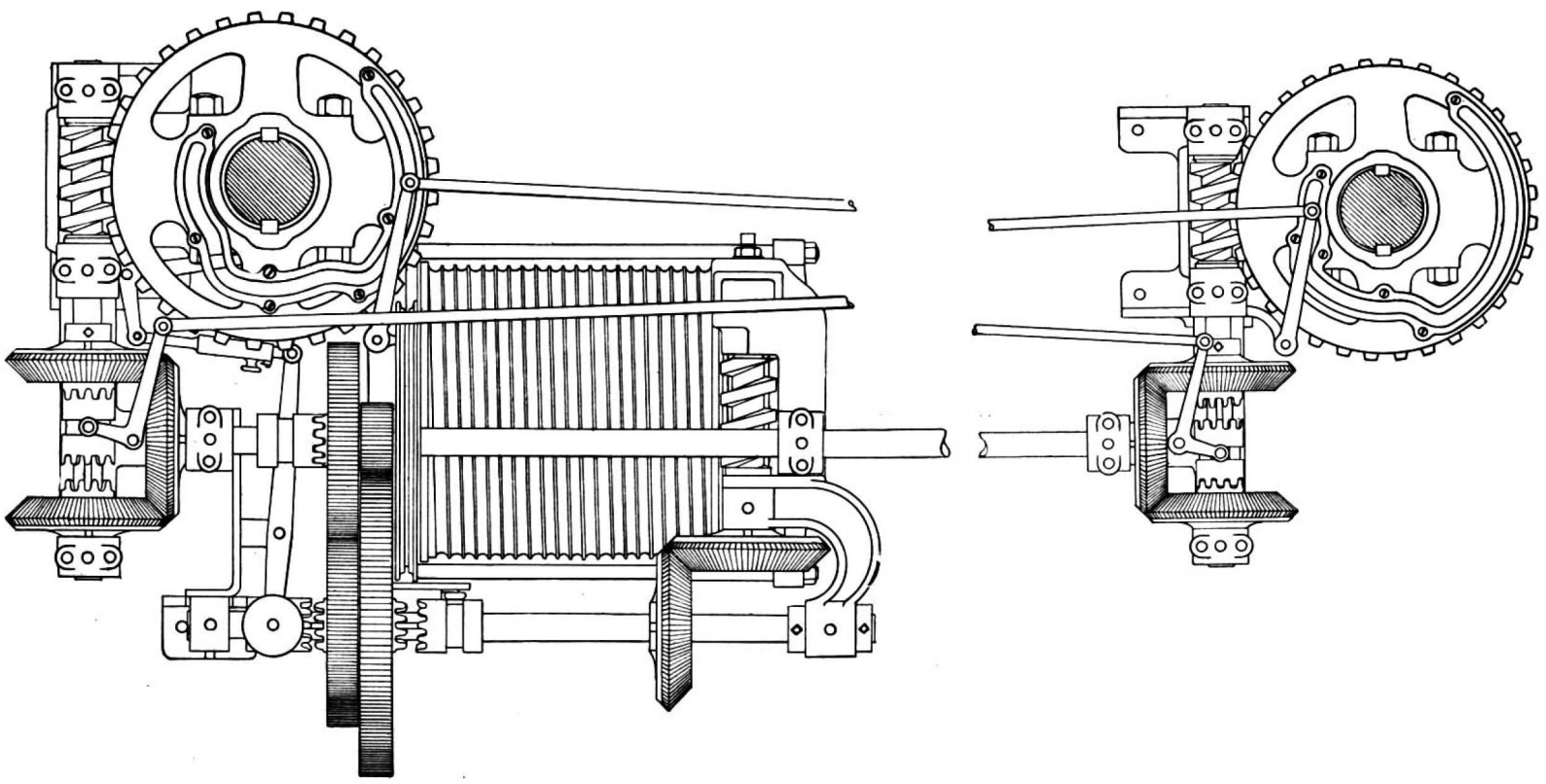
Accidents to Animals.

Among wild quadrupeds only the ruminants with large horns and long limbs seem commonly liable to accidents. Cases of stags dying with interlocked antlers are recorded from time to time, and Buckland gives an account of a curious accident which befell a big stag in Windsor Forest. The poor beast had been standing on its hind legs to nibble leaves from a thorn tree, and caught its hoof in a fork in the trunk. This threw it on its back, and broke the bone. Though red deer are in this country mainly found wild on mountainous ground, we much doubt if they are really a mountain species or specially clever on rocky ground.

Mr. J. G. Millais mentions one pass where the bones of deer that have missed their footing and fallen down the crags may frequently be seen. Broken limbs are very common, even among park stags, generally due to fights in the rutting time. This must usually lead to the death of deer in all districts where large carnivora are found; but the astonishing way in which broken bones, or even worse injuries received by wild animals, cure themselves if the creature is let alone, shows that the most serious accidents need not lead to death, even if left to nature. The most striking of recent instances is the case of a doe antelope at Leonardslee, which smashed its hind leg high up, and so badly that the bone protruded. It would have been shot, but it was observed to be feeding, as if not in pain. It survived the winter, and was seen to swing the injured leg forward to scratch its ear before the bone set. The fracture reduced itself, and the cut skin grew over the place, leaving a scar. Later, though lame, it was perfectly well, and reared a young one.

A tiger recently killed in the hot weather had a bullet wound a week old which had smashed its shoulder. This wound, though a very bad one, was perfectly healthy, and there was evidence that since it was inflicted the tiger had eaten no flesh, but only drank water. In the Waterloo cup coursing in 1886 Miss Glendyne and "the runner up" for the cup were slipped at a hare which went wild and strong. When killed after a good course by the two crack greyhounds, it was found to have only three feet. This may be compared with the accounts of a collie dog, recently quoted in the papers, which had one fore foot and one hind foot cut off by a reaping machine, but which still manages to help with the flock. Dogs, which ought to be little liable to accidents, are very frequent sufferers, largely from their association with man and intense desire to participate in all his doings. One of their commonest mishaps arises from their love of riding in carts. They become quite clever at scrambling or jumping in, but are not "built" for jumping down on to a hard road. If the cart moves as they make their spring the danger is increased, and fore legs broken, usually just below the shoulder, are very commonly seen.

Dogs also have dangerous falls when on the ground, accidents usually ascribed only to bipeds and horses. A greyhound going at full speed will trip, fly head over heels, and break a leg, or even its neck. Master Magrath in 1870 went through the rotten ice of the River Alt, from which Altcar takes its name, while following the hare, and nearly died from the effects. But the strangest mishap which the writer has ever seen fall to the lot of a dog was the case of a setter which "tripped" over a sitting hare. The dog, a large, heavy animal, was ranging at high speed in a field of thinly planted mangold. As it passed between the rows, its hind feet struck something, and it nearly turned a somersault. The object was a squatting hare, which, as the dog flew over in one direction, quietly scuttled off in the other.—London Spectator.



AUTOMATIC LIFE SAVING DAVIT DEVICE.—4.—PLAN OF HOISTING AND TURNING GEAR.

Loss of Visual Acuteness.

It is interesting to compare the visual acuteness of the normal eye before and after the effect of some purely physical cause that may be within the realm of either nature or civilization. Taking a few instances of each for illustration, I will cite from nature first. It is well known that severe illness greatly impairs the acuteness of vision of an otherwise strong eye. Almost the first thing a convalescent will do is to call for a book or newspaper to while away the tedium of the sickroom. Unless warned not to try his eyes too much, he is apt, through forgetfulness, to overtask his accommodative powers or injure the already weakened ciliary muscle. When the rest of his body recovers its normal strength, the eyes continue weak. After straining the eyes more in the vain hope that his sight will improve, the person, if he is wise, will consult experienced help; if otherwise, he will pick up the first pair of spectacles available, regardless of whether they be too strong or too weak for his eyes. Should he finally go to an optician, the latter will often find it difficult to fit glasses satisfactorily.

Other natural causes that affect the eyes are wind, dust, light and heat, when excessive. Eyes otherwise good enough become weak under such conditions. The weakness may be due to an error of refraction, and under most conditions the accommodative power of the eyes is strong enough to overcome the error. But under such atmospheric or climatic conditions as I have mentioned the accommodation is lessened, and the eyes cannot find relief except by the use of glasses. They should generally be convex.

Having mentioned those losses of visual acuteness due to natural causes, next in order are causes produced by civilization. At the outset I will say that if the patient were to change his occupation and take plenty of fresh air and exercise, the optician's services might never be needed, but these "ifs" are in the way and are not to be got rid of by the average individual.

Take a boy from the country, bring him to town and place him at clerical work, writing perhaps all day and into the night. Put him behind a counter and let him stand all day, with an hour free out of 12, or more, or let him sit at a workbench, following a trade that keeps his eyes fixed steadily hour after hour 12 to 18 inches in front of him. Take this same youth with hitherto good eyes and bid him use them day in and day out, reading for a profession, or let him occupy his time in a dimly lighted room, or bend over a desk beneath artificial light all the time. I might go on, giving instance after instance, without particularizing any calling as more harmful than others to the eyes.

Is it a wonder that the children of this generation are wearing glasses along with their grandsires? Old age is no longer the reason for wearing glasses. In nine cases out of ten the young man needs a convex glass to assist his overtaxed eyes in fulfilling their duties.

In addition to these causes of weakened vision, it is hardly necessary to mention the common evils of tobacco and alcoholic stimulants. Again, if the strong constitution of a boy cannot save his eyes for their thousand and one uses, how can frail women escape? The ever increasing army of women workers in shops and offices and the new avenues of employment opening to them swell the number of spectacle wearers. It has been my purpose to point out that it is not the serious and very plain errors of refraction that cause the most of an optician's patronage, and he must often attribute the loss of visual acuteness to other causes.—Dr. H. Ruth, in Jewelers' Weekly.

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RECENTLY PATENTED INVENTIONS.

Engineering.

COMPOUND CONDENSING ENGINE.—John S. Briggs, Poland, Me. This engine has high and low pressure cylinders and a cylindrical valve having ports on one side connecting with the exhaust of the high pressure cylinder, while ports on the opposite side connect with the low pressure cylinder and the condenser, a valve reciprocating in the valve cylinder having a transverse passage connecting the exhaust from the high pressure cylinder successively with the low pressure cylinder and the condenser. The arrangement is designed to prevent back pressure in the high pressure cylinder and to supply the low pressure cylinder as well as the condenser with exhaust steam from the high pressure cylinder.

AIR VALVE FOR WATER PIPE LINES.—Theron A. Noble, Seattle, Wash. For water pipe lines or other chambers containing water, the valve provided by this invention is arranged to let out air when the pipe line or chamber is being filled and let in air when the pipe breaks or is being emptied, thus preventing a collapse, the valve also opening to let out accumulated air that has collected at the summits of the pipe line, without allowing the water to escape, and preventing the hammering of the water. Within the valve casing is a chamber communicating with the atmosphere, a float carrying a valve to establish communication between the chamber and the casing, while a stem separate from the valve projects to the outside of the casing and is arranged to engage the valve.

Electrical.

CIRCUIT CONTROLLER.—William T. Budds, Charleston, S. C. This invention relates to circuit controllers for call box systems, and provides means by which a break in the main wires may be easily located without sending a lineman to find it in the usual manner; also, so arranging the parts that, should a wire be broken, the call will still be operative. The invention provides a controller wheel having a number of peripheral projections indicating the number of the call box, in which it is arranged in the usual manner, the wheel being made by the single operation of a die, and therefore inexpensive, and there being both a metallic and ground circuit, through the latter of which the circuit may be operated should a break occur.

Bicycles, Etc.

BICYCLE STEP.—Heinrich G. Borgfeldt, Brooklyn, N. Y. The bicycle step, according to this invention, is extended at an angle from the pedal crank at its shaft-bearing end, being so placed with relation to the pedal crank that motion will be immediately imparted to the wheel when the weight of the rider comes upon the step, making it unnecessary to take a few steps before mounting, as is ordinarily the case. The step will, in mounting, be nearer the handle bar than is usual, thus rendering the act of mounting much easier.

BICYCLE BALL BEARING.—William J. Tripp, New York City. This bearing, for use on bicycles and other machines, is designed to reduce friction to a minimum, while permitting of readily adjusting the several parts and affording convenient access thereto for repairs, etc. Two collars, each having an inwardly overhanging portion, are secured to the axle, and an additional collar is carried on each overhanging portion, the additional collars being extended inward and contracted, the pairs of collars thus forming an annular ball race, the ends of the hub being projected within the additional collars and the overhanging portions of the first named collars.

Mechanical.

BRACE.—John H. Morrison, Prescott, Arizona Ter. To obtain a high speed for the bit and insure an easy, steady and quick boring of the material, without necessarily increasing the speed of the crank arm to be turned by the operator, is the object of this invention. The tool is provided with a U-shaped frame having upper and lower bearings, in the lower one of which is a sleeve through which passes a vertical shaft carrying at its lower end the tool holder for a bit or other tool, the shaft being also connected by a train of gear wheels with the sleeve, whereby a higher motion may be transmitted to the shaft.

CUTTER HEAD AND CUTTER.—Frank E. Dalzell, San Francisco, Cal. An improvement more especially designed to facilitate turning rosettes, corner blocks, etc., has been devised by this inventor, the cutter head being provided with jaws forming curved slots at adjacent edges for the reception of the cutters, and the cutters being made of thin steel and curved to produce a shearing cut.

SCROLL SAW.—James G. Connelly, Verdon, S. D. To facilitate adjusting and operating the saw and combine therewith a lathe to be operated at will is the object of this invention. The arrangement is such that the saw table remains level, the saw frame being mounted in a yoke and being adjustable, so that the saw frame may reciprocate at any desired angle, while combined with the saw is a head and tail center of a lathe, the parts being so connected that the lathe or the saw may be operated independently, either one being thrown into or out of operation.

TUYERE.—David Summe, Darwin, Ind. To facilitate increasing or diminishing the draught in blacksmiths' forges, this invention provides a novel tuyere with an arrangement for keeping a projecting part cool, with an auxiliary draught opening to keep a smoldering fire when the forge is not in use. The invention comprises upper and lower plates united by lateral flanges and having recesses forming draught passages, the upper plate having perforations communicating with the draught passages, a surrounding channel being also connected with a water reservoir, while the draught passage may be connected with any style of bellows.

BOLT CUTTER.—James R. Rambo, Pulaski, Tenn. This device comprises a hollow head with rigid handle, two slidable parallel jaws being arranged in the head, to which also a handle lever is pivoted, while a jaw lever has a head with projections engaging the jaws, its outer end having pivotal and loose connection with the handle lever. The tool is adapted for bolt cutting in general, but especially for cutting off the ends of tire bolts, which it does squarely and evenly, without leaving any bur.

APRON BOARD FOR PAPER-MAKING MACHINES.—Perry D. Taylor, Watertown, N. Y. This invention provides a board on which the apron may be quickly and conveniently adjusted for any sized sheet without detaching any part of the apron from the board or removing the attaching medium between the board and apron or between the apron and deckle frame. Bars with which are connected angular shields are held to slide in the board, while the apron is sectional, and the sections are attached to the sliding bars and connected with the shields.

Agricultural.

SCYTHE.—Gervais Nolin, Skowhegan, Me. To make a scythe of high grade and uniform quality of steel, the blade is made, according to this invention, with a ribbed back, the blade being formed of one piece and homogeneous in its composition at its edge, back and body, a heel being recessed to the blade and having a socket to receive the rib of the back. By this improved method of manufacture, the steel is heated but a few times and to a lesser degree than by methods heretofore employed.

COLTER BAND.—Thomas J. Mancill, Maben, Miss. A simple and inexpensive colter, which may be fastened to a plow beam without drilling holes in and weakening the latter, is provided by this invention. It comprises a top and bottom bar connected by diagonal side bars, the top and bottom bars having extensions with elongated openings through which hook bolts are passed, while a set screw is passed through one of the side pieces. This colter band may be readily applied to beams of different thicknesses or adjusted to the right or left or vertically, as desired.

PRUNING IMPLEMENT.—John L. Manning, Bartow, Fla. This invention comprises a staff or handle and two pivoted hook-shape cutters, one cutter having an extended shank or lever arm which is pivoted to the handle, the other cutter having a sliding connection with the handle, a pull rod being connected with the extended shank or lever arm, the arrangement being such that a pull on the lever arm operates both cutters simultaneously.

Miscellaneous.

FIRE TRUCK.—Richard J. Voelker, St. Louis, Mo. This invention relates especially to the steering gear of fire trucks, and provides a novel and simple form of latch mechanism by which the steering wheel shaft may be prevented from accidentally jumping or being jarred out of place, and by which the shafts may be removed without displacing the steering wheel.

WEATHER SIGNAL INDICATOR.—J. G. Wall, Brooklyn, N. Y. For use in public and private buildings, offices, stores, etc., this inventor has devised a weather signal indicator to display signals according to the daily reports of the Weather Bureau, comprising a bulletin board formed with means for reading the weather and storm signals, such means being printed, painted, or otherwise arranged on the board with the necessary text to be readily interpreted by the public, in connection with a changeable calendar, graduations with pointers indicating the velocity and direction of the wind, etc. Both air and sensible temperatures are given by the indicator. This inventor has also further protected his weather signal indicator by taking out a copyright thereon.

DOOR SECURER.—Richard D. Williams, New York City. For the use of guests, boarders and travelers, etc., this device is more especially designed, comprising a series of telescoping tubes, the upper one having a flat forked head to engage the shank of a door knob, while the lower one has a toothed foot piece, there being means for holding the head and foot pieces in alignment, and a simple form of locking device to hold the securer extended or closed. The device may be quickly and conveniently applied to lock a door against intruders, and may be telescoped into small space to be carried in trunks and bags, being also available as a handy weapon for defense.

MACHINE FOR CUTTING DOUGH.—Herman Weichert, Jersey City, N. J. For cutting dough in pieces of suitable size for loaves, each piece or loaf having the exact weight required, this inventor has devised a machine to which the dough need only be fed, when it will be automatically expelled from the machine, cut to the required weight. In the receptacle to which the dough is fed is a screw conveyor, there being a reciprocating cutter mounted to cross the outlet of the receptacle, and means for regulating the area of the outlet. An adjustment is provided whereby the weight of dough delivered may be increased or diminished, and any other plastic material may be fed and cut off in a similar manner.

LOCK.—James M. Sweeney, Somerville, Mass. This invention relates to locks in which a casing carries a sliding bolt normally retained by a series of tumblers movable by a specially constructed key, to release the bolt and permit it to be shot, the improvement providing a lock in which the bolt may be operated by a key or by a latch. The upper part of the casing is recessed for any suitable form of latch, and the shape, size, and relative dimensions of the tumblers and key may be changed to produce innumerable combinations, to differ in every lock that is manufactured.

AUTOPNEUMATIC PIANO PLAYER.—Fred R. Goolman, Los Angeles, Cal. In this instrument the pneumatic action, in combination with bellows, valves and tubes, forms the principal part of the mechanism, the control of the entire music, the operating of the expression pedals, and rewinding of the music on the roll after playing being effected without the assistance of the operator, and the instrument being designed to have a more perfect action and a finer and more delicate expression than has heretofore been attained. The instrument may be driven by an electric or water motor, spring or weight motor, as most convenient, the action being intended to fit almost any piano or reed instrument, the shape of the parts being modified to suit.

ENVELOPE.—Albert Butzer, Carlyle, Ill. The blank of which this envelope is made has at one edge a projecting keeper strip and at the opposite edge a locking tongue, cuts in line with the sides of the tongue extending into the blank, and the inner end of the tongue having a delicate connection with the blank. It is designed that the envelope shall be inexpensive to make, and that after having once been closed it may not be reopened without detection.

MUCILAGE HOLDER.—Frank F. Peck, Susanville, Cal. This holder has an overbalanced scraper adapted to be pressed below the level of the mucilage by the brush and to rise above such level on removing the brush, the arrangement being such as to permit of readily scraping off surplus mucilage from the brush, automatically returning it to the chamber or well without clogging the mouth of the holder. This prevents also the loss of mucilage from its becoming hard in drying on the surfaces exposed to the air, and the mucilage in the holder retains its consistency for an additional period, not being liable to become unclean from dust and other impurities.

WRITING TABLET.—William H. Griffin, Hawthorne, N. J. A simple and inexpensive device more especially designed for use in schools, instead of slates, is provided by this invention, the device being adapted to hold loose sheets of paper in the form of a writing tablet. Mounted on one end of a board or backing is a spring-held bar adapted to clamp the paper on one surface of the backing near the end, the bar being held in desired position by the action of the spring.

SCHOOL ROOM DIRECTORY AND BULLETIN.—James S. McClung, Pueblo, Col. This board has a series of clips on its front face to receive information cards bearing on one face the name, age, grade and date of entrance of pupil, with address of parent or guardian, and on the opposite face a record of physical condition, etc., a record card being removably secured on the obverse side of the board presenting a digest of the records of pupils. The improvement is designed to present a record of which all the details will be readily accessible, enabling a principal or superintendent to enter a class room and investigate the history of one or more pupils without disturbing teacher or students.

ANTI-RATTLER FOR THILL COUPLINGS.—Frank P. Johnson, Danville, Pa. This invention covers an improvement on a formerly patented invention of the same inventor, and comprises a bolt for securing the thill to the axle clip, the bolt having one end extended downwardly and inwardly, while a wear plate has its lower end connected with the downward and inward extension of the bolt, a spring engaging the lower portion of the plate and pressing forward its upper portion. The device is designed to automatically take up wear and may be used on both right and left hand couplings.

FIRE ESCAPE.—Joseph Hagel, Mount Sterling, Ill. A slotted tube is arranged vertically as a permanent fixture on a building, according to this invention, a block sliding in the tube being moved by a rope or cable extending from cranks and a drum at the bottom over a pulley at the top of the tube, and there being attached to the block a cage which may be thus raised or lowered, the cage being arranged to be locked at the desired height. The device may be used to permit firemen to conveniently carry and operate hose, as well as to facilitate escape from any of the floors of a building.

DUMB WAITER SAFETY DOOR.—Theodore Grottke, West Hoboken, N. J. To close the doors of dumb waiter shafts at each floor of a building, to prevent fire from spreading therein, and to allow the cage to open the doors noiselessly at each ascent and descent, is the object of this invention, according to which the doors are hinged at one side of the shaft and normally supported horizontally by independent counterbalancing levers, there being sets of door openers at the top and bottom of the cage adapted to successively engage the doors and swing them upward or downward, according to the direction of progress of the cage.

WINDOW SHADE FIXTURE AND CURTAIN POLE SUPPORT.—George Biehn, North Yakima, Wash. This invention relates to fixtures adapted for ready attachment upon the side or top mouldings of window casements without the use of screws or nails, affording a reliable support for the window shade at any desired point on the casement, and also providing for the ready removal of the fixtures without tools. Novel bracket supports for the curtain pole are also provided, which are likewise arranged for attachment or removal without the use of tools.

BED RAIL CLAMP.—Lafayette Weaver, Jr., Bridgeton, N. J. An improved detachable clamp or fastening for securing together the slats that support a bed bottom or springs and the side rails of a bedstead forms the subject of this invention. The clamp comprises a curved or bent main jaw adapted to engage the rail, two slidable auxiliary jaws to engage a slat, while a toggle lever and link are pivotally connected together and connect the adjacent ends of the three jaws. The pivotal connections form an arrangement on an eccentric so that the lever will be self-locking when adjusted.

ARTIFICIAL LEG.—Amos E. Tullis, Fargo, N. D. This leg has an external shell, preferably of raw hide, and inner inflatable air cushion with tube and nipple protruding through the shell, a clamp of special arrangement closing the tube, the arrangement of parts being such as to prevent the air cushion getting out of place, while it may be easily inspected or removed for repairs if necessary. This artificial leg is designed to be conveniently fitted to place and worn without injury or discomfort to the stump of the limb, on which it may be securely held.

COMPOSITE FLOORING OR CEILING.—John W. Piver, Pinia, Ga. A composite board or plank adapted for use in flooring or ceiling, etc., is provided by this invention, being formed of longitudinal strips cut from a flat grain board or plank, the outside strips thicker than the inside ones, and with the edge grain practically at right angles to the wearing surface, thus producing an article which shall be more attractive or ornamental in appearance than composite boards or planks ordinarily used, and with no loss or waste of lumber.

FENCE POST.—Alfred J. Ogram, Literberry, Ill. This invention relates especially to fence post braces adapted to be buried in the ground, providing an angular underground brace and anchor whose horizontal foot is bolted to the base of the post, while an inclined body portion meets an extended horizontal portion and diagonal top brace, both the latter being also anchored to the post.

Designs.

SKIRT BAND.—Elmer W. Towne, New York City. This design presents an ornamental band for the top of a skirt, in which bars arranged in circumferential groups meet a series of transverse bars.

CARPET.—Eugene A. Crowe, Brooklyn, N. Y. Two design patents for carpets and similar fabrics have been granted this inventor, one of which has scroll stems interrupted by foliate figures, combined with diverging leaves, flowers and foliage, the background being of stipple character. In the other design a foliate figure is a prominent feature, with a compound curved stem and leaves and sprays carried by the stem with a feathery effect, the leaves and sprays appearing at the ends as well as at the sides of the stem.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
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Minerals sent for examination should be distinctly marked or labeled.

(7348) L. H. B. says: Can you furnish me the formula for making seal metal, such as is used for the "counters" in notarial and corporate seals? A. Use the following for the counters for seals: Lead, 3 lb.; tin, 2 lb.; bismuth, 5 lb; melt in the order named.

(7349) A. D. T. writes: At my home is a large leather-covered arm chair. Several evenings ago I was very much surprised when I arose from the same and touched the valve on the gas pipe to find that an electric spark emitted from my finger tips. This occurred on repeated trials. In the room there are no metallic bodies other than the gas pipe. Everything I touch is insulated, the chair with the leather, the floor with carpet. The spark may be seen and heard in any part of the room. It is a mystery to me and to all whom I talk to of it. There are no wires of any kind in the house; neither telephone nor light. Any explanation of the above would be highly appreciated. A. You describe the usual experiment of lighting gas with your finger. Had some one turned the gas on, and had you then touched the tip, the gas would have been lighted by the spark. The electricity is due to a charge gained by yourself through friction either against the leather of the chair or the wool of the carpet, probably the latter. Such a charge can only be gained by a nonconductor or by an insulated conductor, such as is the human body when standing on woolen. In cold, dry weather such electrical charges are very easily produced upon the clothing, in the hair, or rubbing paper, silk, or woolen.

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(7350) W. B. B. asks (1) how to make or where to get the bichromate cell spoken of in the article "How to Make a Medical Coil," by S. R. Bottone, in SUPPLEMENT, No. 569. A. SCIENTIFIC AMERICAN SUPPLEMENT, No. 792, price 10 cents, describes with full detail and drawings the bichromate cell, so that any one can make it. 2. Would any good battery do? If so, what voltage will it require? A. Any good battery will do. The bichromate cell has 1 8 volts. 3. Would the Mesco dry battery do? A. You will require two Mesco or other dry or Leclanche cells to equal one bichromate cell. A dry battery will not work the coil as well as a gravity or bichromate battery will do it.

(7351) W. G. H. asks: 1. What is the best battery for running a miniature electric locomotive, for about an hour at a time? A. Use either a gravity or a bichromate cell. 2. For a 75 foot telephone line do I need a battery at both ends? If so, how shall I connect them to the line? A. If you have a permanent magnet telephone, you can use it without any battery. The carbon transmitter requires a cell for its primary coil at each end.

(7352) J. H. T. asks for information about reading telescopes such as are used with reflecting galvanometers, etc. I would like to know lens system and details of construction. A. A reading telescope is a small astronomical or inverting telescope. Many of them are ordinary spy glasses with the erecting lenses removed from the inner tube. Such a spy glass can be bought for a couple of dollars with an object glass about 1¼ or 1⅛ inches in diameter. Mount this on a convenient stand and attach the scale below the telescope. The figures on the scale must be reversed so as to be turned around and stand right after they are reflected by the mirror of the galvanometer. The object glass should be an achromatic lens of 8 inches to 9 inches focus and the eye piece a positive eye piece of about 2 inches focus. These require the tube to be 10 inches to 11 inches long when adjusted for focus.

(7353) E. G. asks what kind of an attachment to put on a common turning lathe for turning round balls. A. As you do not state the kind of balls—wood or metal—we give the process for turning wooden balls and billiard balls. First, turn by a template or gage or by caliper, as nearly spherical as possible. Then make a chuck of wood and fasten it to the mandrel in any way the most convenient. Turn out the chuck hollow so that the ball will enter nearly half a hemisphere. Chuck the ball at right angles to the position that it was first turned in. Turn off the outside or projecting part true by nearly obliterating the lines of the first turning, then rechuck and turn the otherhemisphere. If great nicety is required, as in billiard balls, you will have to continue the chucking in several other positions and turn very carefully with curved tools. A little chalk in the chuck will help the ball to stick. If you have difficulty in holding the ball in, you may put a small false center against the ball, made of iron, with a thin piece of leather waxed upon it to prevent scratching. If this is done nicely, you may do the work without chucking the ball so deep.

(7354) L. H. M. writes: 1. The safety valve of a boiler becomes coated with lime. The boiler never foams. How and by means of what force does it get there? A. Whenever the safety valve blows off, the water beneath is agitated and small particles are lifted and blown through the safety valve. A boiler always foams when it is making steam. The space just above the water line is filled with a water mist raised by the liberation of the steam below the surface, which, on passing the surface, breaks the water in a mist or small particles of water—this is called wet steam—which may be drawn from any boiler having too little steam room. 2. Stand on the opposite side of a darkened room from a lighted lamp. Take a glass mirror and look slantingly across it, so that you can see the several (7 or 8) images produced by multiple reflection. If the brightest image is at the top and the others grow dimmer as you descend, change the mirror end for end, so that you look across it in the opposite direction to which you did at first. The brightest of the several images is now at the bottom and the others get dimmer as you ascend. Will you please explain how changing the mirror inverts the order of the images? A. Some defect in the surface of the mirror produces the change described. A perfect mirror gives the same quality of image in any direction.

(7355) C. E. P. writes: 1. I have a small dynamo that I would like to know what the voltage would be speeded to 2000; dimensions as follows: Field magnet 17½ inches long, 3 inches wide, ½ inch thick, 70 turns of No. 16 wire to each layer, and there are 32 layers, making 2,240 turns in all. Drum armature. The armature is 4 inches in diameter, 3 inches long, eight sections, wound with No. 18 wire, two layers, making in all 400 turns. A. About 30 volts, if your field is cast. If wrought iron, it would be 40 volts. 2. Would this machine make a sufficient exciter for an alternator of the following dimensions for 55 or 110 volts? Ring for fields inside 16 inches in diam ter, with 12 poles and about 4 inches wide, armature 10 inches in diameter. A. Yes. 3. What size wire for this machine to get 110 volts? A. Use No. 16 for field and No. 18 for armature.

(7356) C. A. B. asks for a description of a battery to light from one to five 16 candle power lamps. A. You cannot, except at very great cost, light 16 candle power lamps by a battery. In addition to the materials, it would require one man's labor to keep the battery in proper order. Only very small lamps, 1 to 5 c. p., are ever lighted by batteries, and these more for some especial use, such as lighting a microscopic object, than for either quantity of light or economy.

(7357) C. W. R. asks: 1. What is the difference between an induction coil and an intensity coil? A. We do not know just how the name "intensity coil" may have been used in the place where you saw it. It might be used for an induction coil in which the voltage is raised, as in the Ruhmkorff coil, in distinction from one in which the voltage is lowered and current increased as in an ordinary transformer. 2. How could I wind the dynamo described on page 494, "Experimental Science," for the highest possible voltage and how many volts and amperes would I get? Also, could I use the same for electroplating, introducing resistance enough? A. Wind it like the hand power dynamo, page 487, same volume, and you will have twelve volts and perhaps three amperes. You cannot then use it to advantage for plating; the current is very small. Still, if you put in resistance in the external circuit, it will plate slowly. 3. Would the above dynamo be more powerful if the armature was the same style as the one for the simple electric motor, and if so, what size wire would it be wound with? A. No. There is not room for such an armature between the poles. 4. What would be the voltage and amperage of the above dynamo if the field were excited with two Samson batteries? A. It would make little difference and there would be no use in exciting the fields by external current when the machine can excite its own fields. You can, however, do it if you wish. 5. What voltage and amperage are No. 2 Samson batteries? also of Mesco dry batteries when new? A. All forms of Leclanche cells have about 1½ volts. Their amperes depend on the resistance of the external circuit. On short circuit they might show six to ten amperes, but could not deliver so much beyond a few seconds. They would polarize immediately.

NEW BOOKS, ETC.

FOURTH ANNUAL REPORT OF THE COMMISSIONER OF PUBLIC ROADS. For the Year ending October 31, 1897. Issued under the Authority of Henry I. Budd, Commissioner of Public Roads. Trenton, N. J. 1898.

This is an interesting pamphlet which shows the badness of some roads in the State and the improvements which have been effected in them. The State of New Jersey may well be proud of her splendid network of roads which renders driving and wheeling in many districts delightful. The pamphlet contains several studies on road building which ought to prove of value to all those who are interested in good roads.

A PRIMER OF PSYCHOLOGY. By Edward Broadford Titchener. New York: Macmillan Company. 1898. 12mo, pp. 314. Price $1.

In the last few years psychology has come prominently to the front as a study which should be taught in all high schools and colleges. The author outlines with as little of technical detail as is compatible with accuracy of statement the methods and results of modern psychology, and the reader is stimulated by means of questions and exercises upon the subject matter of the chapters to refer to more advanced treatises. The subject may be introduced either by way of a general account of scientific study or by the way of brain anatomy or brain physiology. The book seems to be admirably adapted for the purpose for which it is intended.

HAWAII'S STORY BY HAWAII'S QUEEN LILIUOKALANI. Illustrated. Boston: Lee & Shepard. 1898. Pp. viii, 409. Price $2.

The present work is an autobiography of Hawaii's late queen. It is particularly timely in view of the probable annexation of Hawaii to the United States. As might be supposed, Queen Liliuokalani, in detailing the events of her life, protests against the revolution which deprived her of her throne and answers the slurs of her adversaries. She throws a new light on the manners and customs of this strange people and the book offers interesting reading. The work is an important contribution to the history of the Hawaiian revolution and the causes which led to it, and the treaty of annexation now pending before the United States Senate, and ought to command considerable attention from the reading and thinking public. The book is handsomely made and is well illustrated by half-tone engravings.

THE ART OF GETTING RICH. By Henry Hardwicke. New York: The Useful Knowledge Publishing Company. Pp. 294. Price $1.50 cloth, 50 cents paper.

The present work tells how fortunes were made in the middle ages and how they are made to-day, as well as sundry hints of how to succeed in business. We are constrained to observe that we do not believe that fortunes can be made by the instructions which can be gotten from this or any other book, but a diligent study of it would tend to inculcate that thrift which has been the basis of nearly all of the large fortunes.

THE REPORT OF THE SUPERINTENDENT OF THE UNITED STATES COAST AND GEODETIC SURVEY. Showing the progress of work during the fiscal year ending with June, 1896. Washington: Government Printing Office. 1897. Pp. 772. Quarto, 19 maps.

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An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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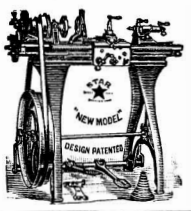

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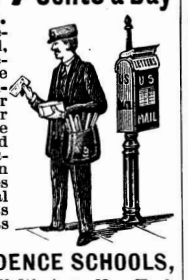

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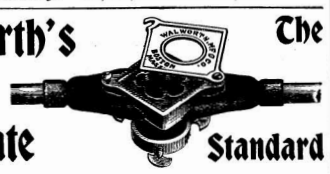

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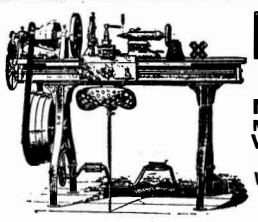

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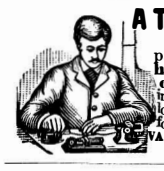

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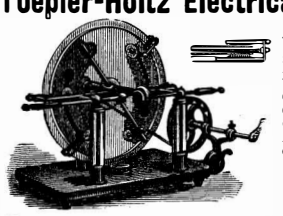

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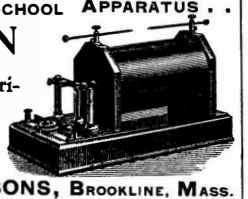

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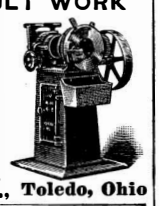

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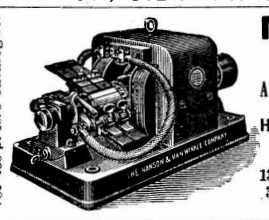

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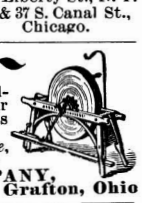

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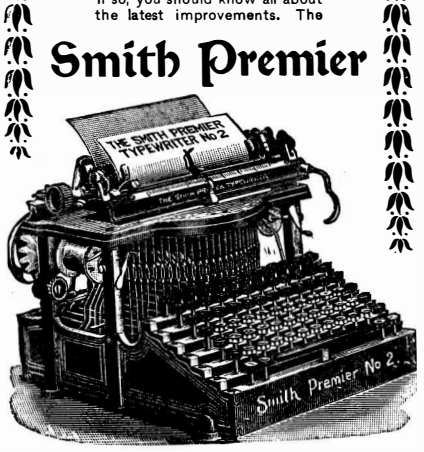

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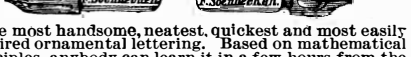

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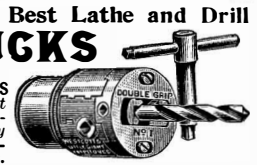

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